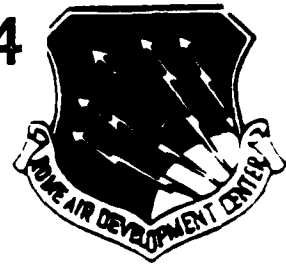


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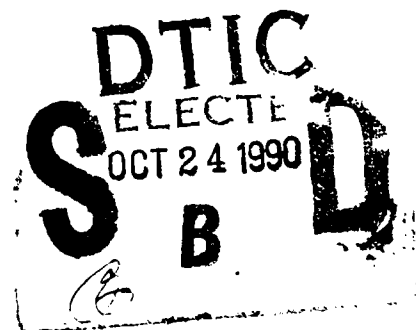


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# THE ASSISTANT FOR SPECIFYING THE QUALITY SOFTWARE (ASQS) User's Manual

Dynamics Research Corporation

Larry Kahn and Steve Keller



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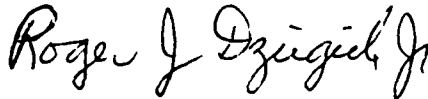
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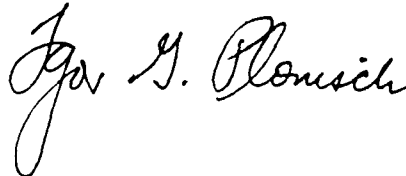
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<p>The ASQS, a knowledge base software tool, assists software acquisition managers which specify software quality requirements. In the consultation mode, questions are presented to the acquisition manager in terms related to the mission area of interest. Answers are transformed by ASQS into tailored quantitative quality goals based on the thirteen software quality factors of the RADC software quality framework. The current version supports the Intelligence and Satellite mission areas.</p> <p>ASQS serves the purpose of transitioning the software quality specification methodology found in the RADC final report RADC-TR-85-37, Vol II (of three), "Specification of Software Quality Attributes - Software Quality Specification Guidebook", into use in the DOD acquisition process. In so doing, it reduces the amount of time and the expertise required to specify meaningful software quality goals. It bridges the gap between software quality concepts and terminology and the system needs and terminology understood by the acquisition manager.</p> <p>(continued)</p>					
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ASQS was developed using DOD-STD-2167 dated June 1985. The tool is decomposed into five top level functions: 1) user interface to implement the window interface, 2) ranker which ranks the quality factors and criteria in priority order, 3) quantifier which generates numeric factor requirements based on an evaluation of the tailored framework, 4) assessor which assesses compliance of the measurements as compared to the required framework, and 5) administrator which handles all administrative functions such as user access and security. The ASQS has been designed to interface with the Quality Evaluation System (QUES) which evaluates the quality of a software system. A tailored framework with quality goals is transported to QUES from the quantifier function. Measurements by QUES are then transported to the assessor function to assess compliance with goals after each life cycle phase.

Features have been implemented to support tool usability. Windows, menus and use of a mouse help make ASQS user friendly. Generic systems for each mission area have been decomposed into functions. For the decompositions of the Intelligence and Satellite areas, rule sets have been developed and tailored. These can be used as references and copied in part to a new system being developed. Other features which have been incorporated include capturing the rationale behind all elements of the quality specification, recording the history of all changes, identifying the location of problems during assessment, and allowing the generation of what if scenarios by changing answers to questions and functional decomposition. Consideration of software quality requirements is now feasible as early as concept exploration and changes to the original and subsequent specifications can be recorded through post deployment.

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## **How To Use This Manual (Read me first!)**

This manual is designed to bring a new user of this system through three stages of learning.

- 1) A conceptual introduction to ASQS (The Assistant for Specifying the Quality of Software) as a software tool for assisting in the specification of quality goals

(Chapter 1).

- 2) General introduction and instruction in the conventions of the Xerox interface using a mouse and windows

(Chapters 2,3,4).

- 3) Specific instruction in the use of ASQS

(Chapters 5-10).

## **The Specification of Software Quality Attributes**

**Guidebooks, Volumes I-III** are a primary source for definition and description of quality factors, metrics and methodology. Users of this system should be familiar with this material.

An understanding of **Chapter 1, The ASQS Concept**, is a necessary prerequisite to understanding Chapters 6-10, which cover the various functions of ASQS in detail. An understanding of Chapter 1 will assist users in placing the detail in Chapters 6-10 into a conceptual context.

Knowledge of **Chapters 2-4** is a necessary prerequisite to being able to use ASQS on the Xerox workstation. These chapters are therefore also a necessary prerequisite to Chapters 6-10.

**Chapter 5, ASQS Windows**, covers the general varieties of windows one encounters in the use of ASQS, including input, output and manipulation of those windows. This chapter too, is an important prerequisite to Chapters 6-10.

**Chapter 6, Roadmaps**, provides the user with an overview of the structure of the ASQS tool, and descriptions of the roadmaps that enable users to move within the various levels and major functions of the ASQS System. Understanding Chapter 6 will assist the user in placing the detail in Chapters 7-9 into a structural context.

**Chapters 7-9** cover in detail the three major functions of ASQS, and are presented in the general order in which they would typically be utilized during the software specification process.

**Chapter 10, User Scenarios, is a somewhat unusual feature of a software manual. It presents a selection of common scenarios to be accomplished by users when specifying software quality. Each scenario includes a brief discussion of relevant issues with page references to Chapters 6–9. These page references point the user to the detailed instructions for using ASQS to complete the scenario.**

**Therefore, this manual is meant to be used first in the sequence that it is presented.**

**However, the nature of the methodology for specifying software quality, and the nature of ASQS, make a completely sequential presentation and use of this manual inappropriate. Users may find that a thorough understanding of each chapter is not possible until subsequent chapters have been explored.**

**Therefore, this manual is also meant to be used as a reference. Tables of contents at the beginning of each chapter should assist in this.**

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# **Chapter 1**

## **The Concept of ASQS**

### **Chapter Contents**

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## **Introduction: Problems of Software Quality**

Software is a critical element of most modern weapon systems, profoundly influencing both effectiveness and cost. Thus many recent DoD efforts to raise quality standards and reduce costs have focused on software improvement. Government officials have zeroed in on such problems as lagging deployment schedules, high development costs, and poor field performance.

A host of obstacles ranging from ever more complex systems requirements, to quickly evolving technology, and new programming languages, have compelled programmers and managers to search for new and better ways to ensure software quality. The Assistant for Software Quality Specification, or ASQS (pronounced Asks), stems from this research. ASQS aims to become an effective enabling technology for quality software.

### **What is Quality?**

#### **Current SQA Methods**

ASQS was developed to fill the gaps in current software quality specifications and quality assurance (SQA) techniques and eliminate the often cumbersome procedures of those methodologies. Currently, many SQA and software acquisition management personnel rely on the Specification of Software Quality Attributes Guidebooks (Vols. I-III) as a framework for specifying and verifying software quality requirements.

Quality, as defined in these guidebooks, is broken down into major quality factors such as: efficiency, portability, reliability, maintainability, integrity. These factors in turn are further subdivided into a set of software quality criteria such as: anomaly management, modularity, self-descriptiveness. Finally, these quality criteria are reduced to elements which can be measured, called quality metrics. An example quality metric of the criteria "anomaly management" would be whether error tolerances have been specified for external data input. This is a specific element of software which can be measured, and if properly implemented it will improve the anomaly management capabilities of the system and thus contribute to the quality factor reliability.

## **An Expert System for Non-experts**

To specify software quality, an evaluator must use a complex set of rules to identify quality goals, select, and specify quality metrics, while keeping in mind a web of intricate interrelationships between diverse quality factors. Not only does this process entail a substantial investment of time to learn and apply, like most software-related activities, it requires significant experience to implement effectively.

### **ASQS's Automated Assistance**

With ASQS, the system is the expert, translating the user's perceptions of system characteristics into a comprehensive set of software quality metric elements and goals. The user may know, for example, that the envisioned system must operate on two different host systems, involving two different off-the-shelf database management systems, yet not realize that this implies the need for high scores for the "criterion" Application Independence and the "factor" Reusability. ASQS allows users to tailor the framework for their program without becoming embroiled in metric-level details.

As a decision-aid for software quality, ASQS relies on a comprehensive knowledge-base founded on two main sources: 1) the rules and guidelines set out in the Quality Guidebooks; 2) years of experience with the Air Force Systems Command and their supporting contractors in applying and evaluating software quality metrics. Moreover, ASQS is continually updated to reflect new experience and/or changes in software quality concepts.

### **ASQS Uses a Mouse & Windows**

ASQS operates in a user-friendly environment, making use of a series of window displays (see Figure 1.1) which are manipulated with an optical mouse. Each of ASQS's functions are flexibly designed to aid a wide range of software professionals throughout the software development life cycle.

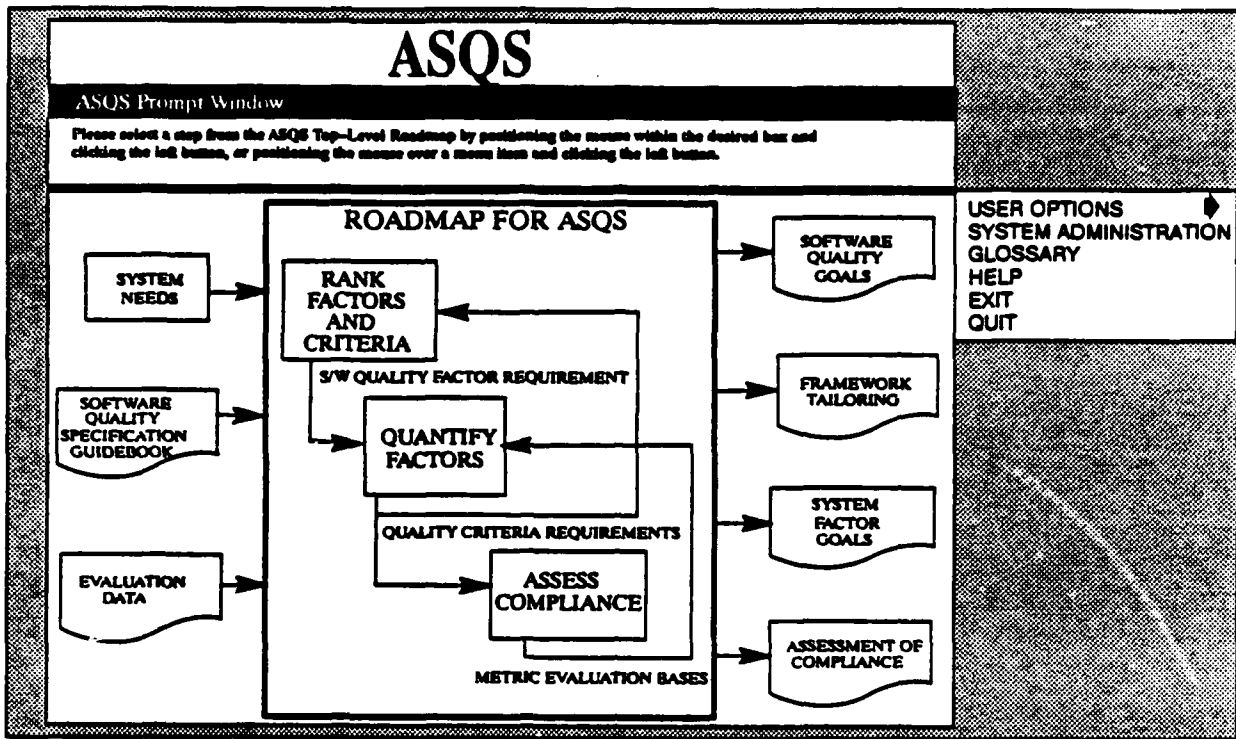


Figure 1.1 Top-Level Roadmap Window for ASQS

## Concept Exploration through Production and Deployment

Unlike many tools which are specific to one software development phase, ASQS is designed to assist software professionals from the concept exploration stage of a system through the production, deployment and maintenance stages of the system. ASQS provides automated assistance in:

- prioritizing quality factors.
- capturing the rationale behind the choices.
- tailoring the metrics framework.
- establishing meaningful numerical goals.
- assessing compliance at each development stage.

From the moment the need for a system is identified, the ASQS Consultation facility guides the user through a structured series of interactive questions designed to help define the essential system requirements and priorities prior to full-scale development. The questions can range from more general characteristics of a software system such as:

ASQS question window	Select:
Is integration framework an embedded system/subsystem ?	YES NO UNKNOWN

...to those that are more relevant to a specific application, such as a fighter guidance system:

ASQS question window	Select:
Does the data base of the integration framework store classified data ?	YES NO UNKNOWN

### ASQS Infers & Branches

Based on the user's responses, ASQS automatically branches to questions concerning other subsidiary issues. As the user works through questions concerning all relevant issues, ASQS makes inferences and draws conclusions regarding software quality requirements. Each inference that ASQS makes reduces the number of questions that the user will have to consider.



**ASQS  
Allows  
Visibility**

At anytime the user can access and investigate the logical chain of rules that ASQS used to reach each conclusion. That is, ASQS does not normally burden the user with cumbersome details, but can provide insights into its logical functioning when desired.

**ASQS Covers  
All Relevant  
Issues**

In addition to making the user consider issues which might have been otherwise overlooked, ASQS can point out interrelationships between diverse areas of software quality that might otherwise not be evident. For example, an increase in software's flexibility may negatively impact survivability. More flexible software is generally less able to perform critical functions without failure in the event of an error.

The net result of a Consultation Session is that ASQS highlights the areas of the proposed system where development and verification efforts should be focused throughout the software development life-cycle.

As a more detailed concept of the system goals evolves over the course of the development life-cycle, priorities are naturally bound to change. ASQS allows the user to easily add, delete, or change characteristics at anytime, and adjusts its conclusions appropriately.

**ASQS is  
Consistent  
with DoD-  
STD-2167**

ASQS supports both the process and products of DoD-STD-2167. The flexible nature of ASQS allows it to support quality throughout the 2167 life-cycle. In the early stages, ASQS automates the representation of system and software functions as described in the System/Segment Specification (SSS) and the Software Requirements Specification (SRS). Later, ASQS can be used to represent and specify quality for lower levels of decomposition such as Computer Software Configuration Items (CSCIs). It is possible to use ASQS at lower levels if desired to specify quality for specific components such as Top Level Computer Software Components (TLCSCs), Low Level CSCs, and even units.

ASQS serves as an aid to developing the quality-related sections of 2167 products. The information captured by ASQS is directly applicable to the development of the system factor requirements in the SSS and the software factor requirements in the SRS.

**ASQS is a  
Project  
Historian**

ASQS documents each version of the software quality specification and records the rationale behind changes. The user can consult and/or return to previous versions of the quality specification. This gives the software development team the ability to run "what-if" scenarios, considering the merits and drawbacks of various proposed alternatives. In this way, ASQS functions as a project historian. ASQS allows software managers to make decisions based on knowledge of past history, providing continuity through changes in project personnel, and changes in project priorities.

Figure 1.2 shows an example of a section of a Version Management Tree, tracing the evolution of different versions of a software package during its life-cycle. Version 1 (V1) can be created to represent the fundamental mission needs and the corresponding software quality needs. Versions 2 and 3 are created by refining needs during the initial formulation of concepts. Version 4 results from evaluation of alternative concepts during concept exploration. This might be compared to a refinement of an earlier concept, such as version 5, or to an alternative derived from the same version, such as versions 6, 9, and 10.

Versions 7 and 8 represent further alternative exploration derived from V6. If version 10 is chosen as the best alternative during demonstration and validation, then version 11 forms the baseline for system/software requirements analysis. Software quality priorities can be incorporated into overall system level quality priorities documented in the System/Segment Specification (SSS). Versions 12 through 17 are further refinements corresponding to each of the life-cycle phases. For example, these refinements might represent a better understanding of quality goals derived from software quality evaluation.

Changes in system needs, changes in the development plan, and feasibility and cost considerations are all potential reasons for refining the software quality goals. Versions 18 and 20 illustrate the evaluation of alternatives that might result during assessment of compliance with quality

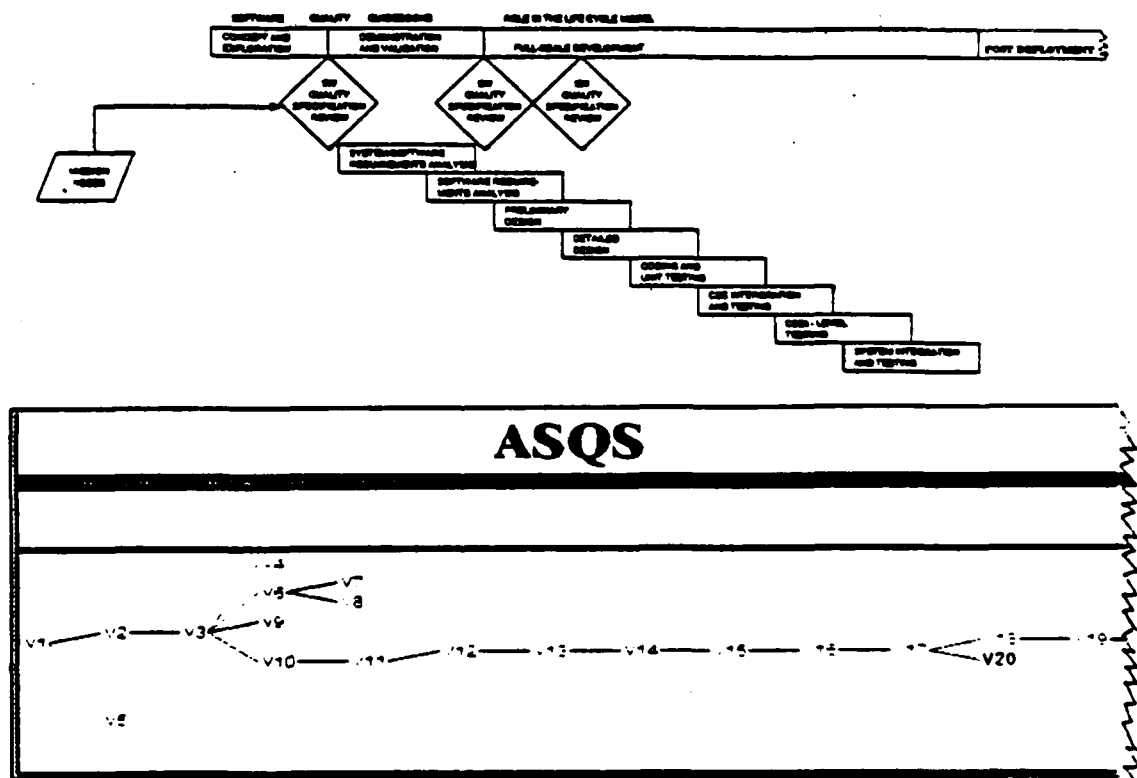


Figure 1.2 ASQS's Version Management Tree

goals to determine a corrective action or appropriate change in priorities. Versions 19 and beyond represent updates to the specification to reflect changes in demands or priorities for the system during post deployment.

Once the software development is underway, ASQS also helps with software evaluation. ASQS complements the Automated Measurement System (AMS), an automated system for evaluating the quality of software based on a comprehensive framework of software metrics. ASQS provides meaningful numerical goals to the AMS for comparison to evaluation results. The AMS computes scores for software quality factors based on the project-specific framework provided by ASQS. The framework is tailored by ASQS to eliminate metric elements that are not applicable to the project to prevent introducing an irrelevant bias into the overall scores. Also, the criteria, metrics and metric-elements are weighted to emphasize the characteristics most important to the project. The evaluation results provided by the AMS feed into ASQS for an in-depth assessment of compliance.

**ASQS Helps  
Pinpoint  
Problem  
Areas**

When a quality problem is identified, ASQS helps the user determine what the problem is and where it originates. Were the goals unrealistic, or did the contractor simply fail to achieve the goals? Were the results biased by the scoring method? How would a further tailoring of the requirements affect the scores? What are the quality trends over the course of the project? ASQS can assist the user in answering all these questions, documenting them in reports for the record.

**Summary**

**Design and  
Development**

In short, ASQS is designed to provide automated support during every phase of the software development process. First, its user-friendly Consultation Session bridges the gaps between software-quality concepts and systems needs, and between quality specific terminology and terminology understood by application-oriented software professionals such as acquisition managers. By aiding in defining quality requirements prior to full-scale development, ASQS can potentially save time and money over the course of a project.

**Project  
Historian**

Second, as a project historian ASQS assists project managers and programmers throughout the development cycle. Its documentation and report-generating functions help keep everyone on the project up-to-date on the latest version and the rationale behind decisions to maintain or change certain features.

**Software  
Evaluator**

Third, ASQS assists software evaluation at every stage. It puts the output of software measurement tools in a meaningful framework, measuring the obtained scores against the target goals based on the defined systems requirements.

**Quality  
Assessor**

Fourth, ASQS assesses the quality needs and characteristics of the project. It provides guidance for improving the consistency and feasibility of the software quality goals. It can tell the user where the problems and shortcomings exist and suggest modifications to achieve more desirable and/or realistic goals.

ASQS is an expert system designed for users with a wide range of abilities. For those who are less familiar with the intricacies of software coding, ASQS can translate a general concept of system functional requirements into a framework of quality metrics. Yet even for those who already have years of experience in quality metrics, ASQS can eliminate many of the tedious and cumbersome processes of current methodologies.

## **Status and Future Development**

The current version of ASQS is a feasibility model created to demonstrate the concept of automated assistance for software quality specification. It contains the essential tool components for ranking software quality factors, considering factor interrelationships, tailoring the framework, and developing numerical goals. It also contains over 350 rules which illustrate these concepts. The current rules support the development of an initial quality specification for the 13 software factors based on system quality factors. Most of the more detailed rules are in the area of reliability.

An ASQS training course was conducted for government and industry personnel with a variety of backgrounds and responsibilities. The course demonstrated that the current version of ASQS is an effective tool for teaching software quality technology. The course also demonstrated ASQS as a promising vehicle for automating the process of software quality specification.

## **Chapter 2**

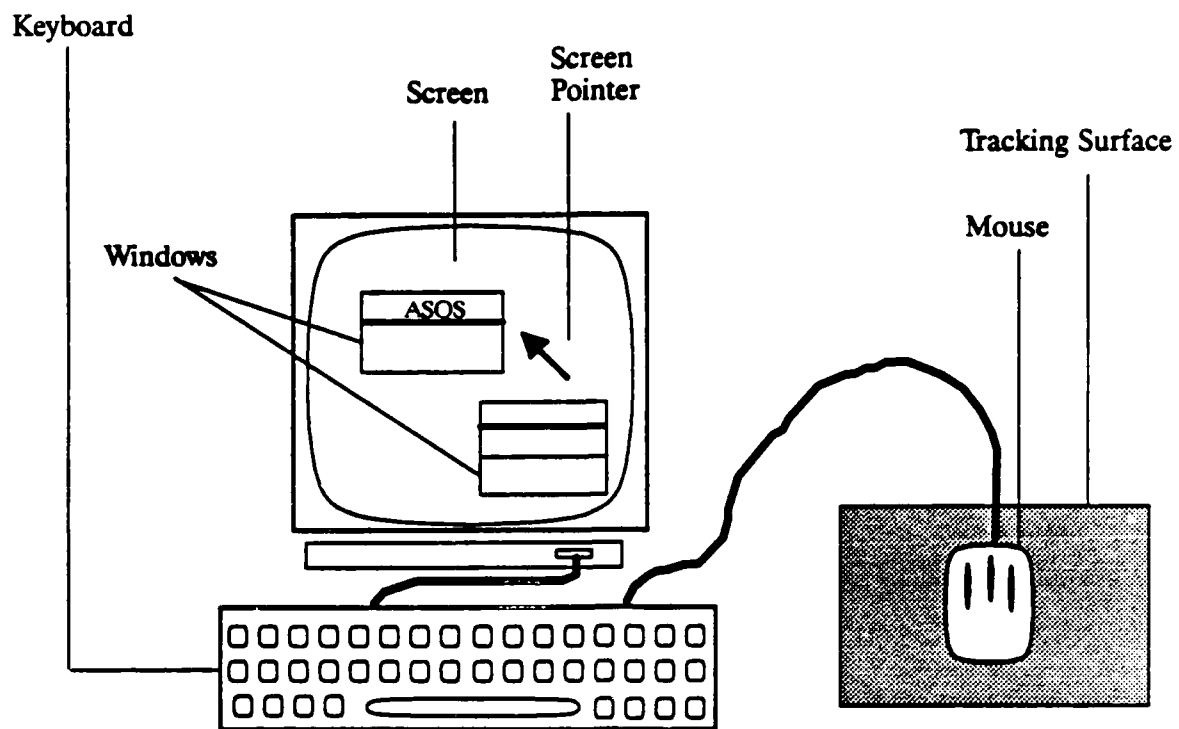
### **Getting Started with the Mouse and Windows**

#### **Chapter Contents**

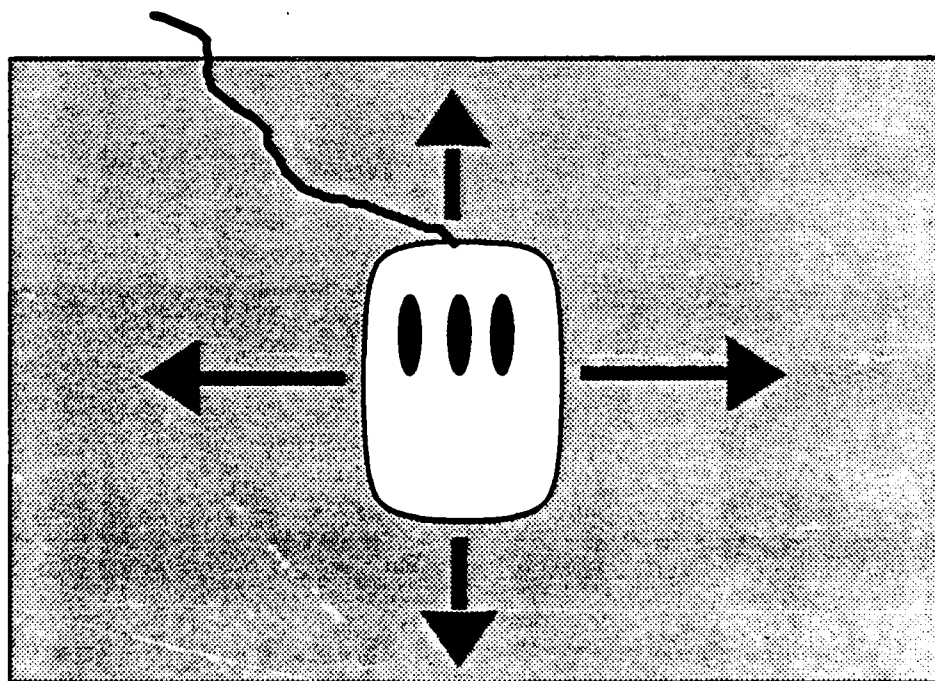
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**Figure 2.1 The Xerox Workstation**



**Figure 2.2 The Mouse**

## **Getting Started**

Before getting started, it is helpful to know a little bit about the hardware and software with which you will be working.

If you have worked with a mouse in a windows environment, you might want to go directly to the section entitled **Using the Mouse and Menus**, page 2-6. There you can find specific information on using the mouse and windows in the Xerox Workstation and ASQS environment.

## **Working with Windows**

If you have never worked with a Mouse or with windows, this section is intended to give you a little background on the tools with which you will be working.

### **The Mouse**

The key piece of hardware for using ASQS is a small input device known as a "Mouse." It is about the size of a bar of soap and is connected to the computer keyboard by a long wire (see Figures 2.1 and 2.2). On the top side of the mouse are three buttons. On the underside of the mouse is a set of photoreceptor cells for detecting the movement of the mouse.



## **Windows**

The mouse is used in a special “environment” known as “Windows.” Each window is a rectangular work area on the screen, distinguished with borders and titles (see Figure 2.1). The windows environment allows a number of work areas to share a single display. The work areas can either belong to the same program or to completely unrelated applications.

For example, think of the screen as analogous to your desk; both are work areas on which you can perform any number of functions, such as writing, drawing, or playing chess. The difference between a desk and a screen, however, is that most software will not allow you to have more than one function on the screen at one time. Before you can use your graphics program, you must exit your word-processing program or your chess game. It is as if you were not allowed to use your desk as a drawing surface until you put all your writing implements and your chessboard in a drawer.

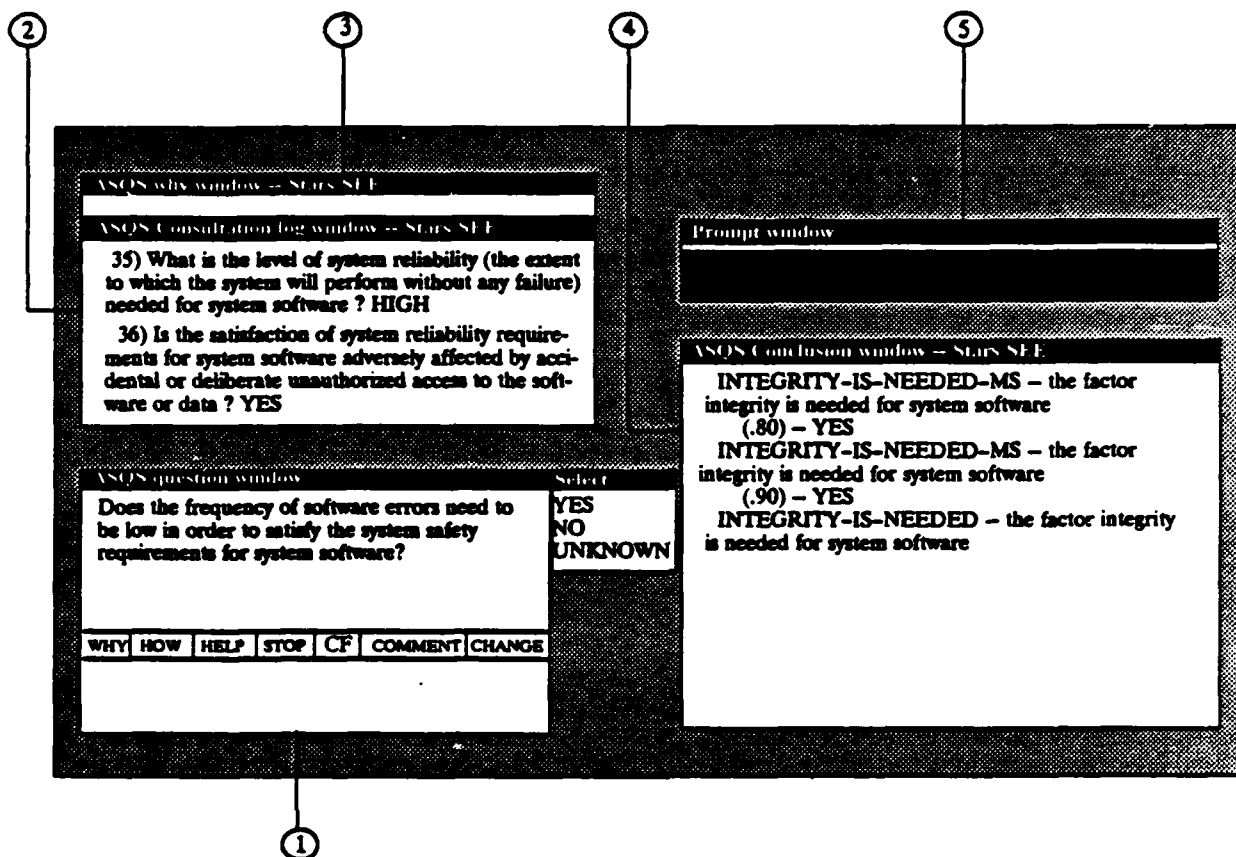
With windows, you can use the screen as you would your desktop. Not only can you have your writing tools next to your drafting tools and your chessboard, but you can easily go back and forth between each function.

ASQS uses the windows environment for two reasons. First, the windows environment allows you to look at a project from many different “angles” at one time.

For example, Figure 2.3 shows an ASQS Consultation Screen with five windows opened at once. Each of these windows has a distinct function. One of the windows is only for system messages to the user, another is primarily for user input, etc.

The second reason for choosing a Windows environment for ASQS is that it is much more user-friendly than a conventional screen environment. Pop-up option menus and Roadmaps eliminate the need to memorize endless lists of keyboard commands. The mouse lets you quickly move to any area of the screen without having to use the keyboard.

This is just a general overview of the environment in which you will be working. How to manipulate the mouse and windows will be covered in the next section. How to use ASQS as a software quality specification tool will be covered in Chapters 5–10.



**Figure 2.3 Five Windows Simultaneously Displayed**

## Using the Mouse and Menus

So that you can easily find the cursor on the screen at any time, a small diagonal arrow (shown below) is used instead of the traditional blinking underline:

### **The Screen Pointer**

This arrow will be referred to as **The Screen Pointer**. By moving the mouse, you can move the screen pointer to any position on the screen.

### **The Tracking Surface**

The mouse must be used with the special cardboard mat known as **The Tracking Surface**. The distinctive pattern on the tracking surface allows the mouse's photoreceptor cells to detect movement.

Position the mouse flat in the center of the tracking surface, with its connecting wire facing away from you (as shown in Figures 2.1 and 2.2). By sliding the mouse straight forward in the direction of the wire (away from you), the screen pointer moves toward the top of the screen. When the mouse is pulled toward you, the screen pointer moves toward the bottom of the screen.

Similarly, by sliding the mouse to the right or left, the screen pointer moves to right or left on the screen.

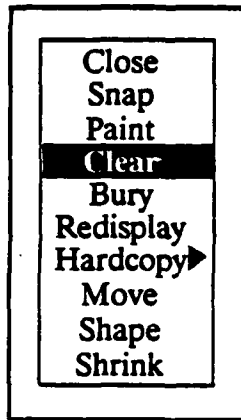
The three buttons on the mouse enable you to give input to ASQS, as well as perform a variety of actions effecting the windows environment. In addition to allowing you to make selections from all ASQS menus, you can open, close, move, reshape or print a variety of windows.

Before going into the different uses of each mouse button, it is important to understand that the computer distinguishes between two logical positions of each button: **pressed down** and **released**. Depending on what type of window you are in, each position of each of the three buttons will mean something different to the computer. There are, nevertheless, a few general rules as to what each button will do.

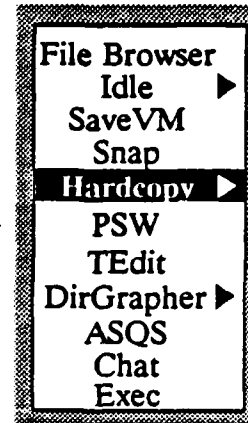
### **The Right Button**

By pressing down the **Right Button**, you can display two different menus. If the screen pointer is within a window, a **Window Utilities Menu** will appear (see Figure 2.4). If the screen pointer is not inside a window, a **Background Utilities Menu** will appear (see Figure 2.5).

As you move the screen pointer over the menu options, each in turn will be highlighted in reverse video. For example, in Figure 2.5 the menu option "Hardcopy" is highlighted. All of these options are described in detail in Chapters 3 and 4. Note, however, that most Window Utilities menus are a subset of the one shown in Figure 2.4.



**Figure 2.4**  
**An Example of a**  
**Window Utilities Menu**



**Figure 2.5**  
**Background Utilities**  
**Menu**

To select options from either of these two menus, simply release the right button when the desired item is highlighted. To continue without selecting a menu item, simply move the screen pointer off the menu so that no options are highlighted and release the button.

**The Left Button**

The **Left Button** is the main button for selecting and executing ASQS functions. Chapter 5 will give a detailed description of these functions and the use of the mouse with them.

**The Middle Button**

The **Middle Button** on the mouse is used to complete functions that have been selected with either the left or right button. In general, ASQS will tell you when to use the middle button.

- \* **Important**—If you accidentally release the button while one of the options is highlighted, that option will be selected. You may cancel by pressing once on the Stop key on the left side of the keyboard.

## Chapter 3

### The Window Utilities Menu

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## The Window Utilities Menu

This section gives a detailed description of the various options available on one or more Window Utilities Menus.

### To display a Window Utilities Menu:

- 1) move the screen pointer within a window area.
- 2) press and hold the right mouse button.

### To select from the Window Utilities Menu:

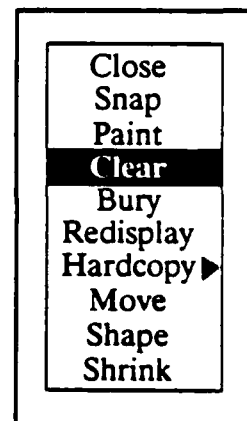
- 1) display the menu holding the right button down.
- 2) move the screen pointer to the desired selection (it will be highlighted in reverse video).
- 3) release the right button.

Because not all options are accessible in each window, the options displayed on a Window Utilities Menu will vary according to where in the ASQS program you are. To determine if a particular option is available for any given window type, press and hold the right mouse button while the screen pointer is within the window area. The Window Utilities Menu which is displayed will contain the options available for that window.

Figures 3.1a and 3.1b illustrate two examples of Window Utilities Menus. Figure 3.1a is the Menu of available options at the Top-Level Roadmap. Figure 3.1b is a Menu with all available options displayed.



**Figure 3.1a**  
A Window Utilities  
Menu for the  
Top-Level Roadmap



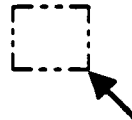
**Figure 3.1b**  
A Window Utilities  
Menu displaying  
all the options

## Snap

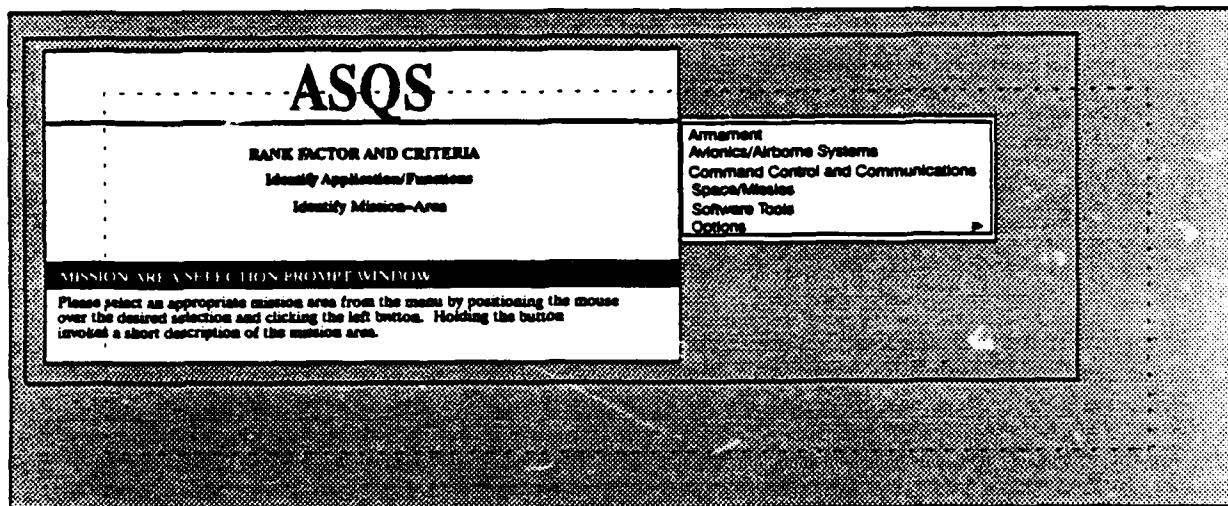
The snap option allows you to make a copy of any image displayed on the screen. This "snapshot" can be put aside for future reference, saved as a file, or printed. However, the snapshot will not function as if it were the original object. You are allowed to define rectangular snapshots only.

To make a snapshot of a region of the screen:

- 1) Position the screen pointer within a window, press the right mouse button to display the Window Utilities Menu and select "Snap."
- 2) A small box will appear at the tip of the screen pointer: As you move the screen pointer around, the box will follow.



- 3) Move the box so that it is over the **upper left-hand** corner of the intended subject area. Press and release the middle mouse button. This will anchor the upper left hand corner of the box.
- 4) Drag the screen pointer to the diagonally opposite corner of the subject of the snapshot. As you move the screen pointer, the box will expand to form a frame around the subject.
- 5) When you have completely surrounded the intended subject, press and release the middle mouse button. This makes the actual snapshot, and a new window is created to store it.
- 6) A ghost frame will appear, (see Figure 3.2). As you move the screen pointer the frame will move with it. Position the frame in the desired location. Press and release the middle mouse button.
- 7) If you wish to print, reposition, or delete your snapshot, or convert it to an icon, you may use the **Hardcopy**, **Move**, **Close**, or **Shrink** functions available on the Window Utilities Menu inside the snapshot window.



**Figure 3.2** A "Snapshot" of a Banner Window with a ghost-frame for placing the new window containing the snap



## **Hardcopy**

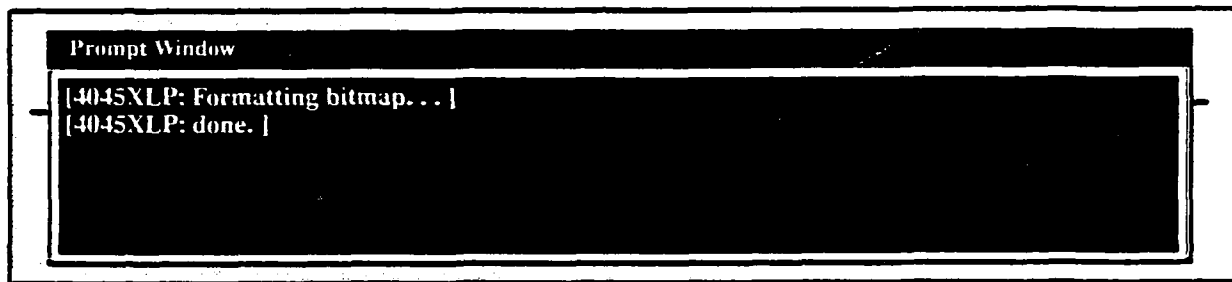
The Hardcopy option allows you to send a "snapshot" of any area of the screen either to a printer (the default option) or to a file.

To make a hardcopy:

- 1) Make a "snapshot" of the area of which you want a hardcopy. (See instructions under Snap.)
- 2) Position the screen pointer within the frame of the snapshot, display the Window Utilities Menu, and select "Hardcopy."
- 3) Note that there is a small arrowhead after the word "Hardcopy." This indicates that there is a sub-menu containing options for the destination of your output. If you wish to choose the default options, skip to Step 5. (Default options: To a Printer, Installed Printer).
- 4) If for any reason you wish to send a hardcopy to a file or to a printer other than the one specified as default during system installation, slide the screen pointer off the edge of the Window Utilities Menus at the arrowhead, while still holding down the right mouse button. This will display the sub-menu. Move the screen pointer to highlight the option you wish to choose, and release the button to select it.
- 5) If you did not choose the default options, you will be prompted for the appropriate input. Otherwise, your print-job will be sent automatically to the default printer.

\* If you select the Hardcopy option from the Window Utility Menu without first making a snapshot, you may get a printout of only part of a window.

- 6) Messages will appear in the black System Prompt Window indicating that the bitmap is being formatted. Wait until the message "done" appears before continuing your work. (See Figure 3.3).
- 7) If you wish to save your snapshot for future reference, you may want to convert it to an icon using the Shrink option. You can get rid of the snapshot using the Close function.



**Figure 3.3** The System Prompt Window indicating that the computer has finished sending output to the printer

## Shrink

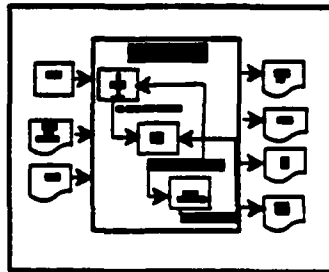
The Shrink function allows you to temporarily convert certain ASQS windows into small symbols known as icons. Figures 3.4a and 3.4b illustrate two examples of icons, one for the Top-Level Roadmap, and the other for a snapshot.

Shrinking is especially helpful when you have a number of windows that you need to be able to reference quickly, but do not want to have them taking up screen space.

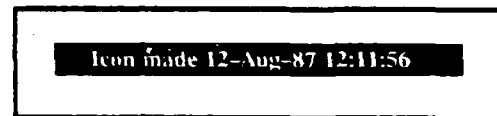
See Chapter 5, ASQS Window Types, to determine which windows may be stored as icons.

To shrink a window to an icon:

- 1) Position the screen pointer within the window, press the right mouse button to display the Window Utilities Menu, and select "Shrink."
- 2) You may Move the icon as you would any other window. To restore the icon to a normal size window, use the Expand function.



**Figure 3.4a**  
An Icon for the  
Top-Level Roadmap



**Figure 3.4b**  
An Icon for a  
"Snapshot"

## Expand

This option allows you to restore an icon to a regular window after it has been reduced using the Shrink function. (See Figure 3.5.)

To expand an icon to a window:

- 1) Position the screen pointer on top of the icon that you want to expand. Press the right mouse button to display the Window Utilities Menu, and select "Expand."
- 2) The icon will disappear from the screen and the window will reappear in the same location it was before it was originally reduced.

A shortcut to expanding an icon into a window is simply to click on the icon with the middle mouse button.

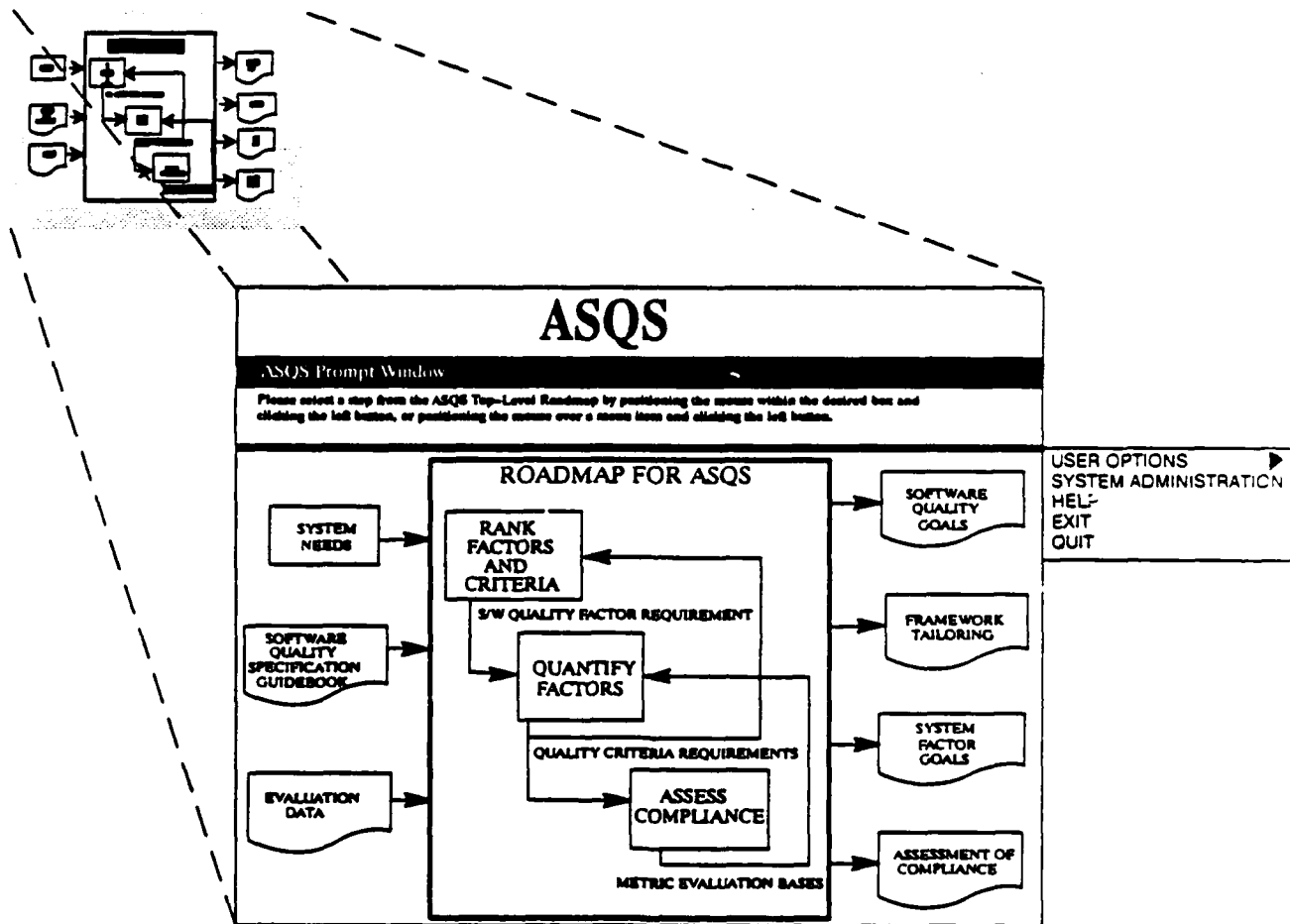


Figure 3.5 A Roadmap Window in Icon form and in Expanded Form

## **Close**

The Close option allows you to close a window that you have created.\* For example, when you make a "snapshot" of a region of the screen, a new window is opened to store the snapshot. Once you have finished with the snapshot, you can get rid of it by closing the window containing it.

To close a window:

- 1) Position the screen pointer within the window that you want to close. Press the right mouse button to display the Window Utilities Menu, and select "Close."
- 2) The window will disappear from the screen.

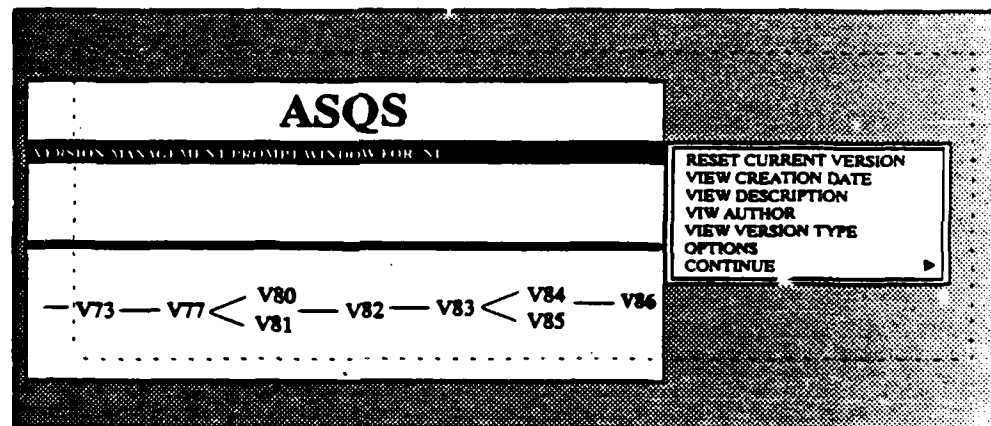
\* Important - Do not attempt to execute the Close function in any windows generated by ASQS. This could cause serious problems with your files. ASQS provides options on its Top-Level Roadmap for Exiting and Quitting an ASQS session.

## Move

The Move option allows you to relocate a window to another area of the screen.\*

To move a window:

- 1) Position the screen pointer within the window that you want to move. Press the right mouse button to display the Window Utilities Menu, and select "Move."
- 2) A ghost-frame covering the same area as the current window will appear. If the window has an attached ASQS menu, the size of the ghost-frame will reflect the added width (see Figure 3.6).
- 3) Position the frame at the desired new location for the window.
- 4) Press and release the middle mouse button. The window will appear in the new location.



**Figure 3.6** An ASQS Tree Window with a Ghost-frame. Note that the width of the ghost-frame takes into account the attached menu

- \* The system will not allow you to pull a window off the screen display. If you wish to relocate a window such that part of it is beyond the edge of the screen, you must push it off the screen. To do so, initiate the Move function in a corner of the window opposite the part which will be pushed off screen. In general it is not good practice to move windows off screen.

## Shape

The shape function allows you to change the dimensions of many ASQS windows, permitting you to view more information at any given time.

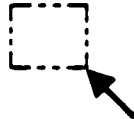
When a window is reshaped, only the area through which you view information is changed, not the actual size of the document. If you make a window twice as large, you are not magnifying the document two times, rather you can view twice as much of the document at once.

For example, as a Version Management Tree (VMT) becomes larger, it is impossible to display the whole Tree in the default size window (see Figure 3.7). By increasing the dimensions of the VMT Window, you can see much more of a VMT at one time.

(See Chapter 5, ASQS Window Types, to determine which windows may be reshaped.)

To reshape a window:

- 1) Position the screen pointer within the window that you want to shape. Press the right mouse button to display the Window Utilities Menu, and select "Shape."
- 2) A small box will appear at the tip of the screen pointer: As you move the screen pointer, the box will follow.



- 3) If you wish to reshape the window in its current location, go to step 4A. If you wish to reshape the window in a new location, go to step 4B.

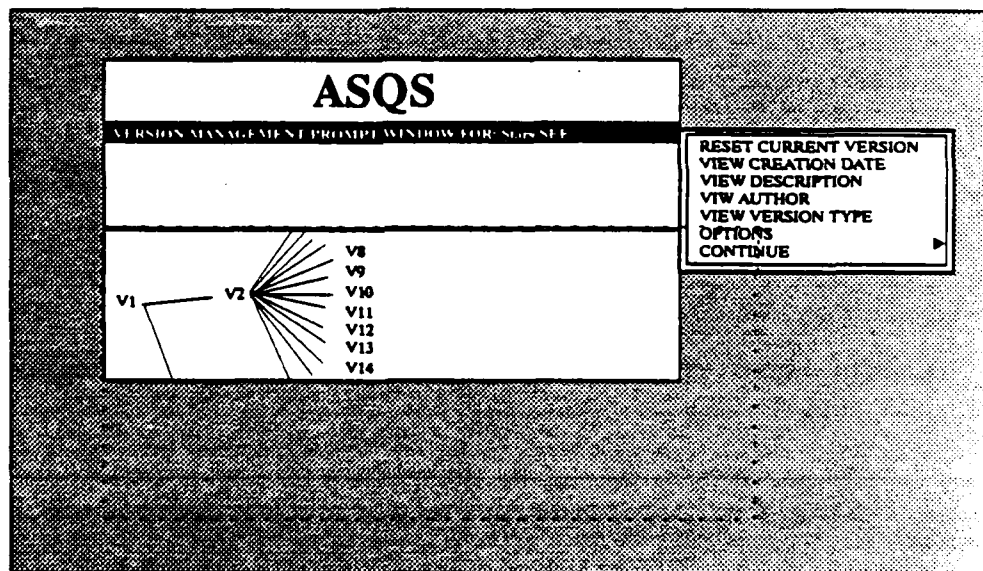
**Shaping in  
the Same  
Location**

- 4A) Press and hold the middle mouse button. A ghost frame, anchored in the corner opposite the one closest to the screen pointer, will appear (see Figure 3.7). While holding the button down, reshape the frame to the desired dimensions of the new window. Release the mouse button. The newly shaped window will appear.

or

**Shaping  
in a New  
Location**

- 4B) Move the small box to the desired location for the new window. Press and hold the left mouse button. A ghost frame will appear with the upper left hand corner anchored. Move the mouse to shape the frame to the desired dimensions. Release the mouse button. The newly shaped window will appear.



**Figure 3.7 A Version Management Tree Window with a ghost-frame indicating new size of the Window**

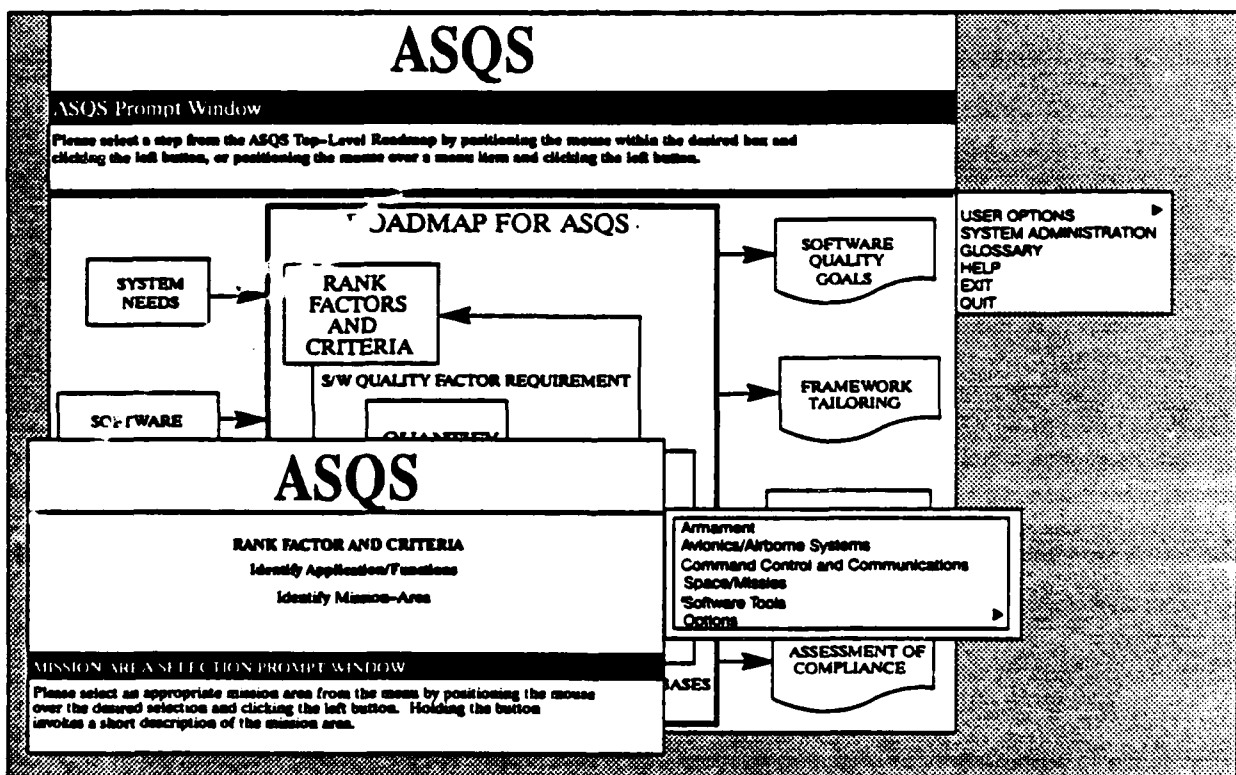


## Bury

The Bury option allows you to move a window to the bottom of a stack of overlapping windows (see Figure 3.8). This is useful when you have multiple windows open at one time and the information you wish to consult in one window is obscured by another overlapping window.

To bury a window:

- 1) Position the screen pointer within the window that you want to bury. Press the right mouse button to display the Window Utilities Menu, and select "Bury."
- 2) The window will move to the bottom of the stack.
- 3) To move a buried window back to the top, move the screen pointer to an exposed area of that window, press and release the right mouse button. If no part of the buried window is exposed, simply "Bury" or "Move" the windows covering it.



**Figure 3.8** A window containing a "snapshot" of a Roadmap Window is obscured beneath a Banner Window

## **Clear**

The Clear option allows you to delete the entire contents of a window. In general, the "graphic" portions of most ASQS windows cannot be deleted, but text and messages can be cleared.

You may consult Chapter 5, ASQS Window Types, to determine which windows can be either partially or completely cleared.

The contents of some windows, if cleared accidentally, can be brought back with the Redisplay function.

To clear a window:

- 1) Position the screen pointer within the window that you want to clear. Press the right mouse button to display the Window Utilities Menu, and select "Clear."
- 2) If the window does not go blank, this means that it is one which cannot be cleared.

\* It is important to note that clearing a window does not delete anything from a project or from disk. It clears the display only!

## **Redisplay**

The Redisplay option prompts the system to redraw a window or its contents. In general, the majority of ASQS windows do not have a redisplay capability. You can consult Chapter 5, ASQS Window Types, to determine which windows can be either partially or completely redisplayed.

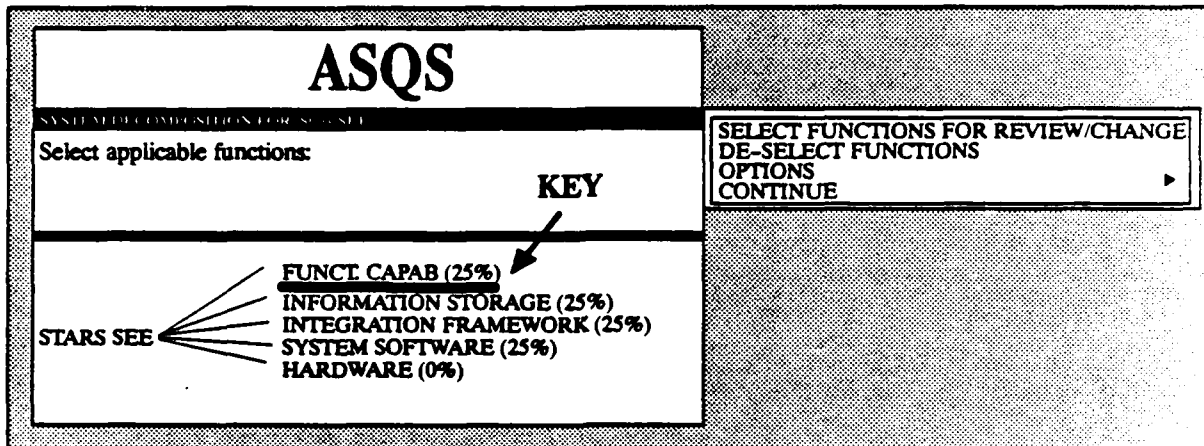
In some instances the redisplay function will restore the contents of a window which has accidentally been cleared.

To redisplay a window:

- 1) Position the screen pointer within the window that you want to redisplay. Press the right mouse button to display the Window Utilities Menu, and select "Redisplay."
- 2) The window will vanish briefly and then be redisplayed.

## Paint

The Paint option allows you to draw on snapshots of ASQS windows. This option can be useful for making notations on presentation materials (see Figure 3.9).



**Figure 3.9 An ASQS System Decomposition Window with a notation made using the Paint option**

### To Paint on a Snapshot:

- 1) Make a "snapshot" of the area which you want to paint. (See instructions under Snap).
- 2) Position the screen pointer within the snapshot frame. Press the right mouse button to display the Window Utilities Menu, and select "Paint."
- 3) The pointer will change to a painter font.
- 4A) Press the right mouse button to display a menu of font options. Release the button to select as an option what is highlighted by the cursor.
- 4B) Press the left mouse button to paint by moving the pointer. As soon as you release the button, the pointer will stop painting.
- 4C) Press the middle button to erase by moving the pointer. Release the button to stop erasing.
- 5) You can print your snapshot with the painted markings simply by selecting the Hardcopy option.

\* **Important – Do not attempt to Paint directly on an ASQS screen. This could mar a bit-map image such that the system would have to be restarted with new images.**

## **Chapter 4**

### **The Background Utilities Menu**

#### **Chapter Contents**

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## The Background Utilities Menu

Since most ASQS users will rarely need some of the options available on the Background Utilities Menu, this chapter will describe in detail only the few functions which are generally useful. These are described first.

For the remainder of the Background Utility Menu options, we have provided general descriptions for informational purposes only. These are listed in the table of contents under Miscellaneous. Ordinarily, only highly-experienced users and the system administrator will use these functions. For in-depth information see the Xerox workstation user's manuals.

### To display the Background Utilities Menu:

- 1) move the screen pointer so that it is not within any window area.
- 2) press and hold the right mouse button.

### To select from the Background Utilities Menu:

- 1) display the menu holding the right button down.
- 2) move the screen pointer to the desired selection (it will be highlighted in reverse video).
- 3) release the right button.

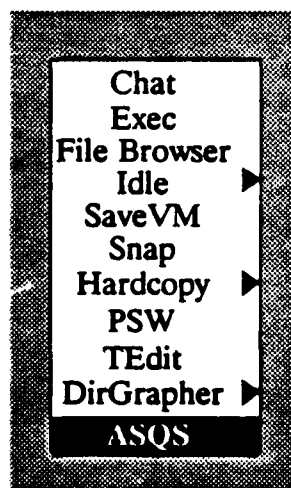


Figure 4.1 The Background Utilities Menu

## ASQS

The ASQS option is used to initiate or return to an ASQS session. A detailed description of the various ASQS facilities, and instructions on how to use them, are contained in Chapters 5–10.

To call up ASQS:

- 1) Position the screen pointer so that it is not within a window. Press the right mouse button to display the Background Utilities Menu, and select "ASQS."
- 2) You will be prompted to enter your user name and the password. Enter this information with the keyboard.
- 3) Once the valid password has been entered, the Top-Level Roadmap for ASQS will appear (Figure 4.2). Refer to Chapters 5–10 for detailed information on using ASQS.

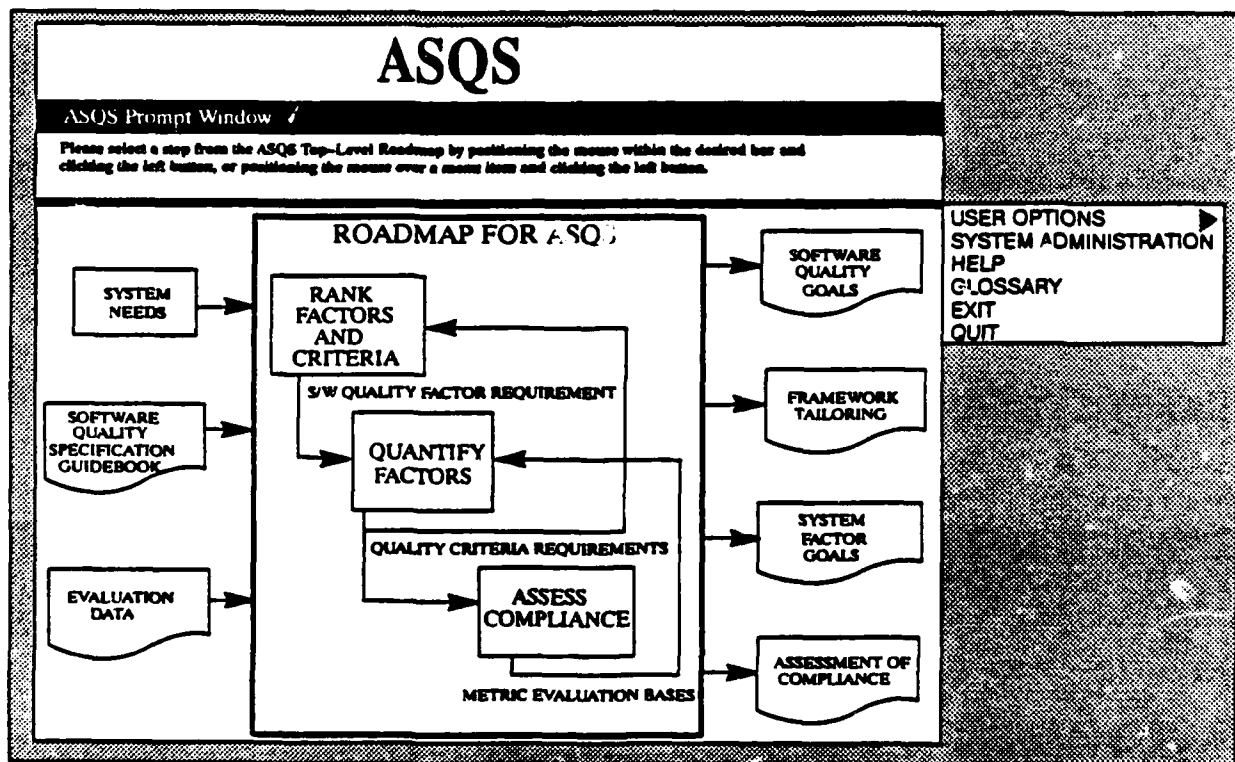


Figure 4.2 The Top-Level Roadmap is displayed upon entering ASQS

## SaveVM

Interlisp allocates a virtual memory storage space much larger than the physical memory on the computer. By continually swapping pages between the physical memory and the hard disk, Interlisp functions as if it had much more physical memory than it actually does.

Because of the constant swapping, at any given moment the total state of Interlisp virtual memory is stored partially on disk and partially in memory. The SaveVM option causes the entire virtual memory to be updated on the disk. Then, should the system need to be restarted, (because of a power failure or a system crash) no work will be lost.

The Xerox workstation also allows you to specify a set time interval at which the virtual memory will be saved automatically. The default setting specifies that the virtual memory will be saved every ten (10) minutes.

See pages 12.6ff. of the Interlisp-D Reference Manual (Volume 1) for complete information on the SaveVM function.

To save the Virtual Memory:

- 1) Position the screen pointer so that it is not within a window. Press the right mouse button to display the Background Utilities Menu, and select "SaveVM."



## **Idle**

The Idle option allows you to put the Xerox workstation into the idle mode in order to save the phosphor of the display screen. Sub-menus for the Idle option also provide a variety of functions related to the automatic timeout period and setting re-entry access.\*

When the system enters the idle mode, whether automatically or by intention, no ongoing process is affected. To return to your work simply press and release the middle mouse button.

To enter the idle mode:

- 1) Move the screen pointer so that it is not within a window. Press the right mouse button to display the Background Utilities Menu, and select "Idle."
- 2) To indicate that the workstation is in the idle mode, the screen display will darken and generate a graphic image or display a moving logo.
- 3) To exit the idle mode, press and release the middle mouse button. You will return to the point at which the system went into the idle mode.

\* The sub-menu options for Idle should be set only by an authorized system administrator. Playing with these options could threaten the integrity of the system security.

## Hardcopy

The Hardcopy option allows you to send a "snapshot" of any area of the screen either to a printer (the default option) or to a file.

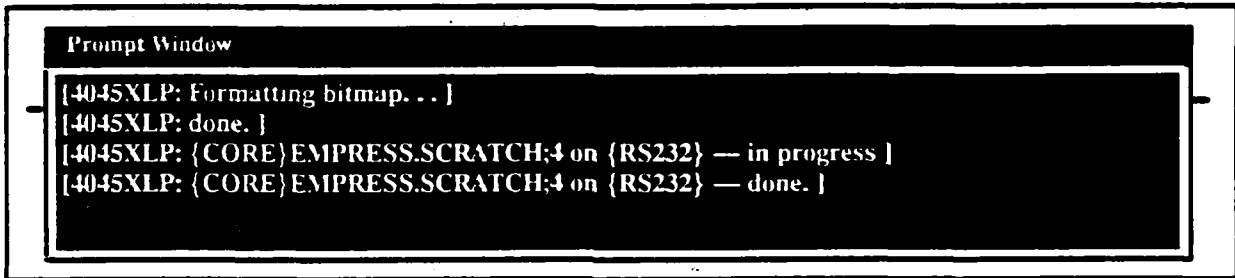
An alternate way to make a hard copy is described in Chapter 3, The Window Utilities Menu.\*

To make a hardcopy:

- 1) Move the screen pointer so that it is not within a window. Press the right mouse button to display the Background Utilities Menu, and select "Hardcopy."
- 2) Note that there is a small arrowhead after the word "Hardcopy." This indicates that there is a sub-menu with options for the destination of your output. If you wish to choose the default options, skip to Step 4. (Default options: To a Printer, Installed Printer).
- 3) If for any reason you wish to send a hardcopy to a file or to a printer other than the one specified as default during system installation, slide the screen pointer off the edge of the Background Utilities Menus at the arrowhead, while still holding down the right mouse button. Move the screen pointer to highlight the option you wish to choose, and release the button to select it.
- 4) If you did not choose the default options, you will be prompted for the appropriate input. Once the printer or file has been specified either by you or by default, a small box will appear in place of the screen pointer.
- 5) Position the upper left-hand corner of the box over the upper left-hand corner of the intended subject of the hardcopy.
- 6) Press and hold the middle mouse button. As you drag the mouse, a ghost-frame will appear and grow. Surround, with the ghost-frame, the intended subject of the hardcopy.
- 7) Release the mouse button to send a bitmap of the subject to the printer.

\* If you are not experienced in handling the mouse, it is better that you first make a snapshot of the intended subject as described in Chapter 3, under Snap and Hardcopy. By making the snapshot before sending the image to print, you are sure of your subject without having to tie up the printer and slow up processing capacity.

- 8) A message will appear in the black System Prompt Window indicating that the bitmap is being formatted. You must then wait until the message "done" appears before continuing your work. (See Figure 4.3).



**Figure 4.3** The System Prompt Window indicating that the computer has finished sending output to the printer

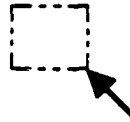
## Snap

The snap option allows you to make a copy of any image displayed on the screen. This "snapshot" can be put aside for future reference, saved as a file, or printed. However, the snapshot will not function as if it were the original object. You are allowed to define rectangular snapshots only.

**Snap** on the Background Utilities Menu is identical to **Snap** on the Window Utilities Menu (page 3-4).

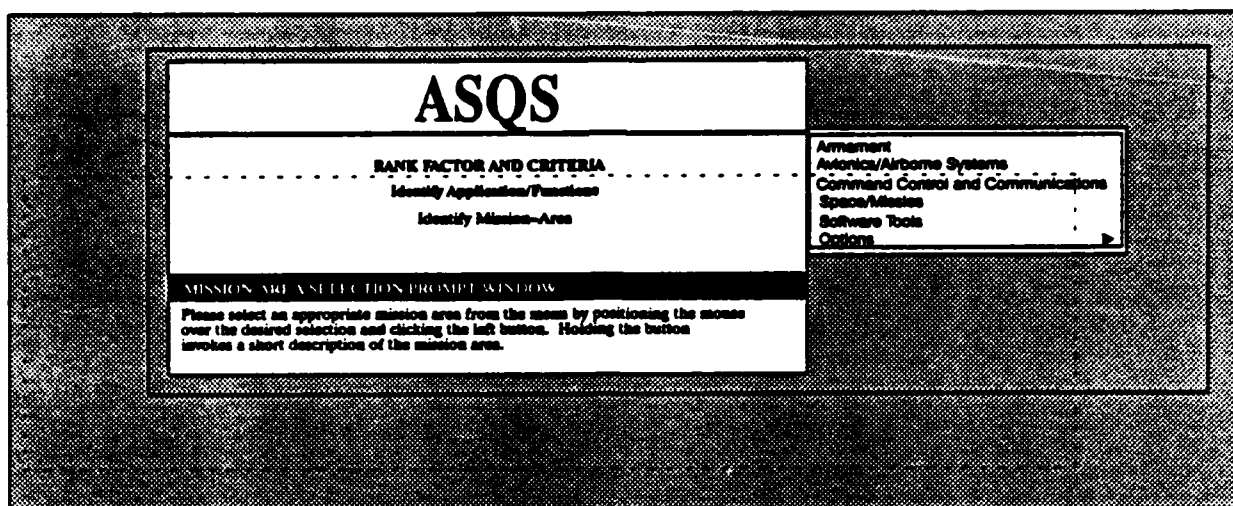
To make a snapshot of a region of the screen:

- 1) Position the screen pointer so that it is not within a window, press the right mouse button to display the Background Utilities Menu and select "Snap."
- 2) A small box will appear at the tip of the screen pointer:



As you move the screen pointer around, the box will follow.

- 3) Move the box so that it is over the **upper left-hand corner** of the intended subject area. Press and release the middle mouse button. This will anchor the upper left hand corner of the box.
- 4) Drag the screen pointer to the diagonally opposite corner of the subject of the snapshot. As you move the screen pointer, the box will expand to form a frame around the subject.
- 5) When you have completely surrounded the intended subject, press and release the middle mouse button. This makes the actual snapshot, and a new window is created to store it.
- 6) A ghost frame will appear, (see Figure 4.4). As you move the screen pointer the frame will move with it. Position the frame in the desired location. Press and release the middle mouse button.
- 7) If you wish to print, reposition, or delete your snapshot, or convert it to an icon, you may use the **Hardcopy**, **Move**, **Close**, or **Shrink** functions available on the Window Utilities Menu inside the snapshot window.



**Figure 4.4 A "Snapshot" of a Banner Window and ghost-frame for positioning the snapshot window**

## DirGrapher

The DirGrapher option creates a graphic tree-structured diagram of the current organization of directories and subdirectories on the disk. Using the mouse and the DirGrapher window (Figure 4.5a), you can create, delete, and back-up directories, as well as move files between directories.

Often when you begin work on the Xerox workstation, you will find a DirGrapher window already open. If you find it is in your way, rather than Close the DirGrapher, it is better to Move the window or Shrink it to an icon (Figure 4.5b). You will find that the DirGrapher takes a good deal of time to re-open. Should the icon be in your way, simply Move it to a empty corner of the screen.

See pages 134ff. of the Lisp User Packages Manual for complete instructions on the use of the DirGrapher.

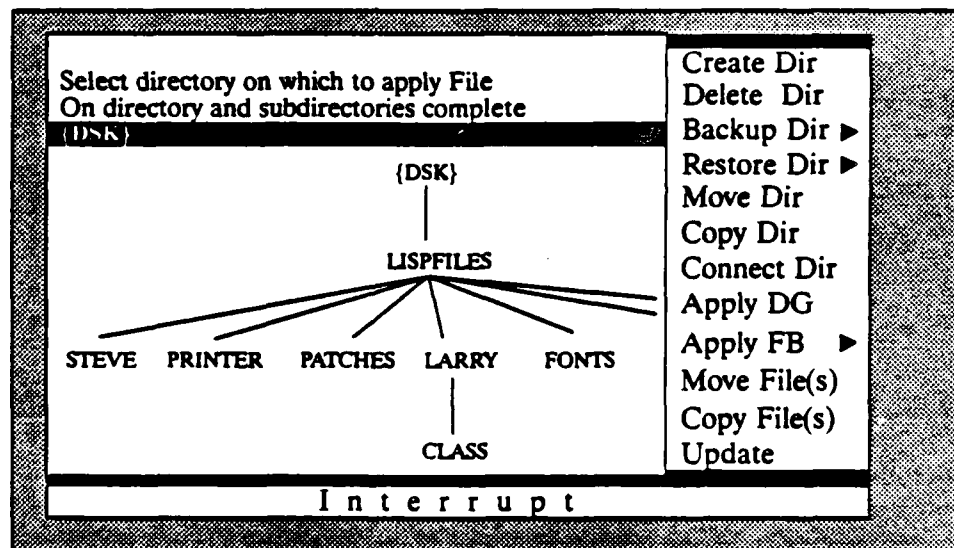


Figure 4.5a The DirGrapher Window

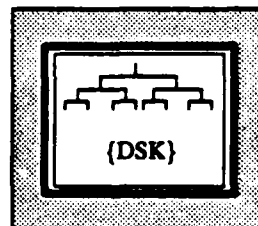


Figure 4.5b A DirGrapher Icon

## FileBrowser

The FileBrowser option allows you to access a user-interface for manipulating the files stored on the workstation or file server. The File Browser enables you to view, edit, delete, print, load, copy, move, rename, compile and retrieve information about files or groups of files. The File Browser can also be used in combination with the DirGrapher for quick and easy manipulation of files.

The File Browser creates a window with an attached command menu (see Figure 4.6), enabling you to select operations and files with the mouse.

See pages 132ff. of the Lisp Library Packages Manual for complete instructions for the use of the File Browser.

File group description: *.*		
Enumerating {DSK}<LISPFILES>EMYCIN2>*.*;*. . . done		
{DSK}<LISPFILES>EMYCIN2>*.*;*. browser		FB Commands
Total: 73 / 6219 pages	Deleted: 0 / 0 pages	
Name	Pages	Created
ASK.DCOM;10	55	3-Aug-87
BONUS.3	46	16-Jun-87
BONUS.DCOM;2	24	16-Jun-87
BUILD.;10	7	7-Aug-87
BUILD.9	7	6-Aug-87
BVMISC.2	26	7-Apr-87
BVMISC.DCOM;1	21	7-Apr-87
CHANGES.SAMPLE;19	275	1-Sep-87
CHANGES.SAMPLE;18	273	1-Sep-87
CHANGES.SAMPLE;17	270	1-Sep-87
CHANGES.SAMPLE;16	265	31-Aug-87
Delete ▶		
Undelete ▶		
Copy ▶		
Rename ▶		
Hardcopy ▶		
See ▶		
Edit ▶		
Load ▶		
Compile ▶		
Expunge ▶		
Recompute ▶		

Figure 4.6 The File Browser Window

## PSW

The PSW option opens a process status window (Figure 4.8), allowing you to examine and manipulate all the existing processes.

The window consists of two menus: the top one lists all processes running at the moment; the bottom lists commands which can be executed on the process selected in the top menu.

See pages 23.16ff. of the Interlisp-D Reference Manual (Volume 2) for complete information on the use of the PSW option.

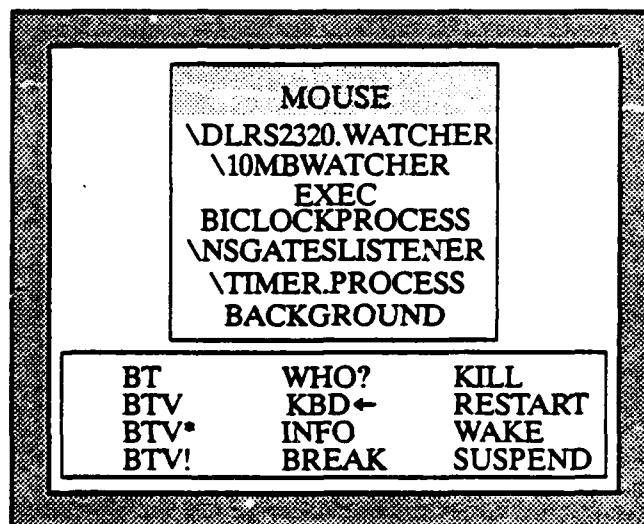


Figure 4.7 A Process Status Window with the "process" MOUSE selected



## TEdit

The TEdit option opens the Interlisp text editor window (Figure 4.10). TEdit is useful for entering, editing, formatting and printing documents and reports related to the ASQS functions.

TEdit allows you to perform many of the same functions as regular word-processing programs used on personal computers such as the Apple Macintosh.

See pages 35ff. of Lisp Library Packages Manual for complete instructions on the use of the TEdit option.

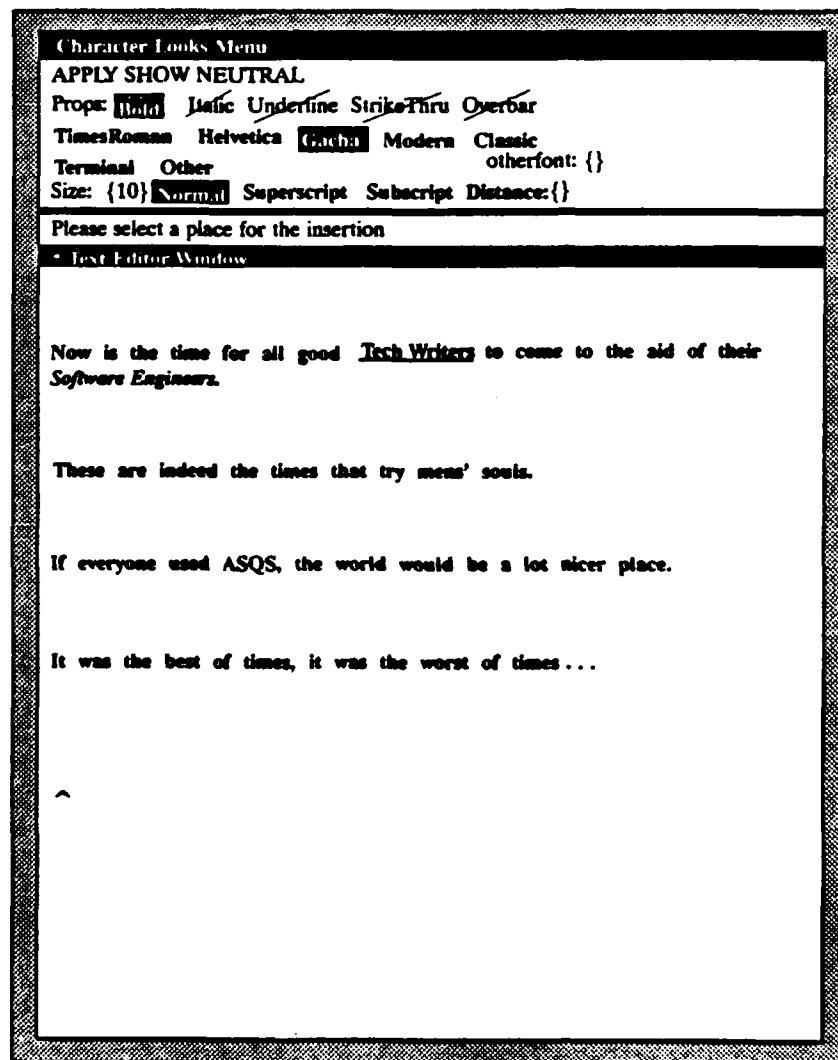


Figure 4.8 A TEdit Window with the Font Change Option Menu

## **Chapter 5**

### **ASQS Window Types**

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## **Introduction**

As you work with ASQS, you will encounter numerous different windows. Each will vary in appearance, available menu options, and functions.

However, this wide variety of ASQS windows can be classified into five basic types:

- Roadmap Windows
- Banner Windows
- Consultation Windows
- Tree Windows
- Ranking Windows

The first part of this chapter discusses:

The System Prompt Window (not an ASQS window) and the features common to many ASQS windows:

- Sub-menu indicators
- The Options sub-menu
- Scroll bars

The second part of this chapter presents examples of each of the five basic ASQS window types. Each is accompanied with a description of its purposes, functions and operations.\*

\* While providing the most general information on using specific window types, this chapter does not go into how to best use ASQS as a software quality specification tool. That will be discussed in detail in Chapters 6-10.

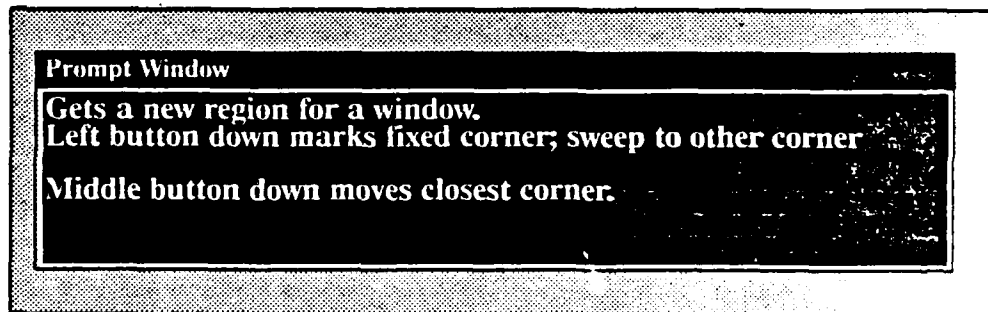
## **The System Prompt Window**

As you are working in ASQS, you will notice a long black box, labeled "Prompt Window," in one corner of the screen. This is the System Prompt Window. The System Prompt Window has two purposes:

- 1) It displays status messages concerning the Xerox workstation and its input/output devices. For example, when you send a job to the printer, the System Prompt window will tell you when the workstation starts and finishes sending output, and when the print job has started. (See Figure 3.3 or Figure 4.3.)
- 2) It displays Help messages for the Window Utilities Menu and the Background Utilities Menu options.

To display these messages, move the screen pointer to the option for which you desire Help, press and hold the right mouse button. Figure 5.1 shows the System Prompt Window displaying a Help message for the Shape option.

Occasionally, the System Prompt Window will be partially obscured by an overlapping window. The prompt window will automatically move to the top of the stack as soon as a system message comes up. It will automatically be buried again when you continue working in any window that it is covering.



**Figure 5.1 The System Prompt Window displaying a help message for the Shape function**

## General Window and Menu Information

### Sub-menu Indicators

Many choices appearing on the various menus throughout ASQS are followed by a small gray arrowhead. The menu choice "Option," for example, will always have such an arrowhead (see Figure 5.2a). This arrowhead is known as a sub-menu indicator. It tells you that there is a sub-menu providing further options related to the menu choice which it follows (see Figure 5.2b).

To display the sub-menu: \*

- 1) Move the screen pointer to the menu choice having a sub-menu. Press and hold the left mouse button. The menu choice will be highlighted in reverse video.
- 2) While still holding the mouse button, slide the mouse until the screen pointer moves off the menu at the sub-menu indicator. The sub-menu will appear and remain displayed for as long as you hold the mouse button in the down position.
- 3) To select one of the options on the sub-menu, highlight it as you would a regular menu choice and release the mouse button.

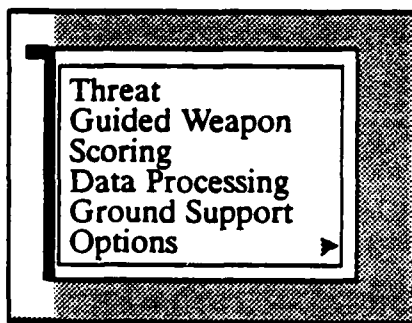


Figure 5.2a

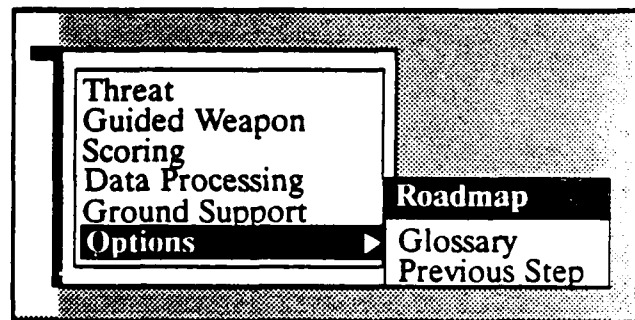


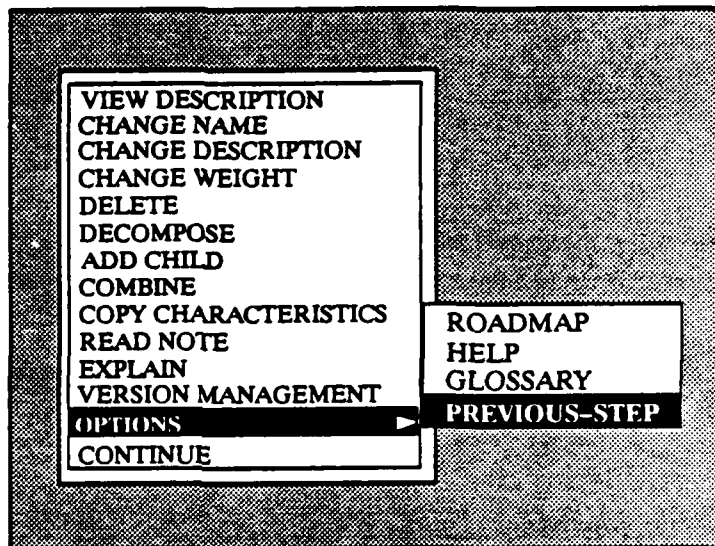
Figure 5.2b

Figure 5.2a shows an attached menu for a Banner Screen. Note the sub-menu indicator after the menu choice "Options." Figure 5.2b shows the same menu with the sub-menu displayed.

- \* If you release the mouse button while the sub-menu is displayed, regardless of whether or not a sub-menu choice is highlighted, the menu choice on the upper menu will be selected.

### The Options Sub-menu

The Options sub-menu is the most common sub-menu throughout the ASQS system. Figure 5.2b on the previous page, and Figure 5.3 below show Options Sub-menus.\*



**Figure 5.3 An Options Sub-menu**

Options Sub-menu selections function as follows:

**Roadmap:** This selection backs the user all the way out to the Roadmap for the major ASQS function which they are now using.

**Help:** When you select Help, ASQS displays context-specific information about the purpose and functions of the current window. You select Help by highlighting the selection.

**Glossary:** When you select Glossary, ASQS opens a window to display an on-line version of the ASQS Glossary. You select the Glossary as you would any other choice on the Option menu. Figure 5.4 shows the Glossary window, which can be re-shaped to any desired size and scrolled up, down, right, and left, using the side and bottom scroll bars (described later in this chapter). When you select a Glossary Term with the left mouse button, ASQS displays the definition in the ASQS Help Window as shown in Figure 5.5.

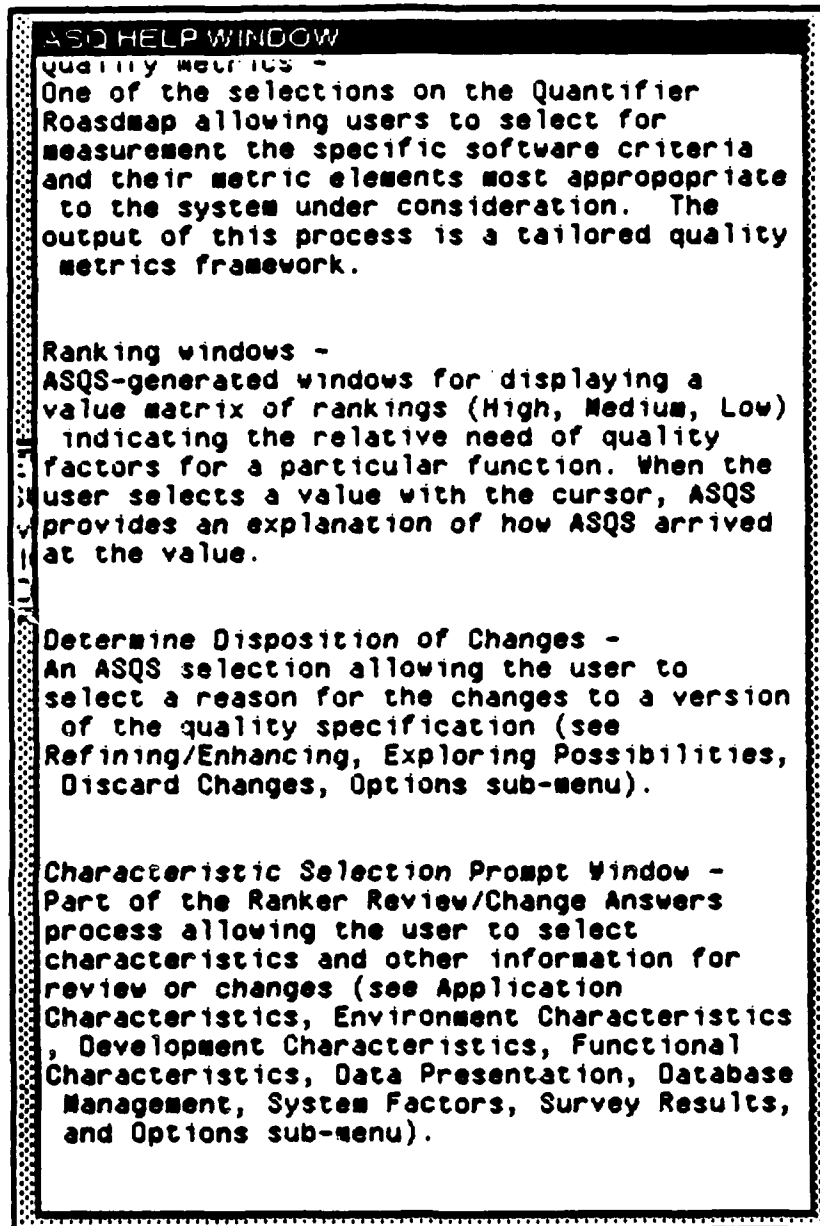
**Previous Step:** This selection backs the user out to the step immediately prior to the current one.

- \* **Note:** Figure 5.3 also shows the selection "Continue." Many attached menus in the ASQS system have this choice. Users need to select "Continue" when they are ready to proceed to the next step or function. Typically, whenever "Continue" appears on an attached menu, it is necessary to select it in order to proceed.

ASQS Glossary of Terms	
<b>A</b>	DoD DOD-STD-2167A
Advanced decision system	<b>E</b>
Add Child	Environment characteristics
Aircraft software	Expand
Answer Window	Expert system
Application characteristics	Explain
Armament	Exploring Possibilities
ASQS	<b>F</b>
ASQS Roadmap	Factor Gauges Panel
Assess Compliance	Factor Gauges Panel Window
Assessor Roadmap	Factor Identification Form
Assign Factors and Criteria Rankings	Factor Ranking Window
Attached menu	FileBrowser
Avionics/Airborne Systems	Flight control system
<b>B</b>	Functional characteristics
Banner Window	<b>G</b>
Baseline	G-How
Bury	Guided weapon system
<b>C</b>	<b>H</b>
CF	Hardcopy
Change	Help
Change Answer	How
Change Name	<b>I</b>
Change Weight	Identify Application/Function
Characteristic Selection Prompt Window	Identify Mission Area
Child	Identify Project
Clear	Identify Software Type
Close	Idle
Coding and Unit Testing	Incremental Pointer
Command Control and Communications	Intelligence system
Comment	<b>L</b>
Compare Goals With Project Data	Launch vehicle system
Compiler	List Properties
Conclusion	<b>M</b>
Conclusion Window	Metrics framework
Consult and Show Rankings	Mission Area
Consultation	Mission Area Selection Prompt Window
Consultation Log Window	Mouse
Consultation Screen	
Continue	
Copy Characteristics	
CSC	
CSC Integration and Testing	
CSCI	
CSCI-level Testing	
CSU	

Figure 5.4 The ASQS Glossary Window, Listing the Glossary Terms

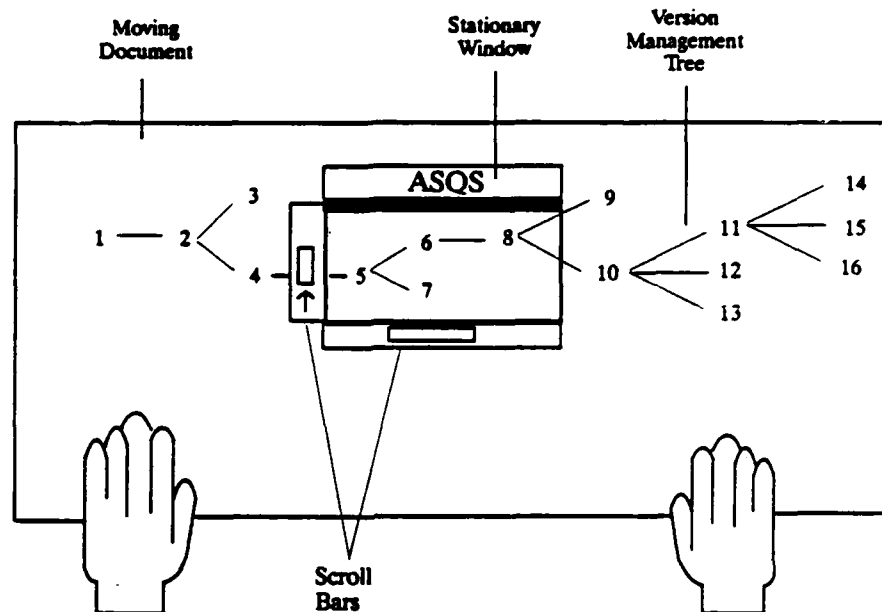




**Figure 5.5 The ASQS Help Window Displaying Definitions of Glossary Terms**

## Scroll Bars

Sometimes an ASQS window can become so large that it cannot be completely displayed on the screen at one time. Examples would include extensive Tree Windows, or the Consultation Log Window of the Consultation Screen. (See illustration in Figure 5.4.)



**Figure 5.6 Using Scroll Bars is like sliding a large document back and forth under a small frame**

In order that you may move quickly from one area to another in such large windows, scroll bars have been provided. Scroll Bars are the small oblong boxes which appear on the bottom and left-hand sides of scrollable windows.

### To display a scroll bar:

- 1) Start with the screen pointer inside the window area
- 2) Move the pointer just outside the window area by sliding across the left-hand or bottom edge of the window.

The scroll bar will appear and remain as long as the screen pointer is within the scrolling area. The scroll bar will vanish again as soon as you move the screen pointer outside of it.

When you move through a document using scroll bars, it is as if you were sliding a large document around underneath a small stationary frame (the window). When you want to see the extreme right of the

document, you must slide the whole document to the left. When you want to see the bottom of the document, you must slide the whole document up.

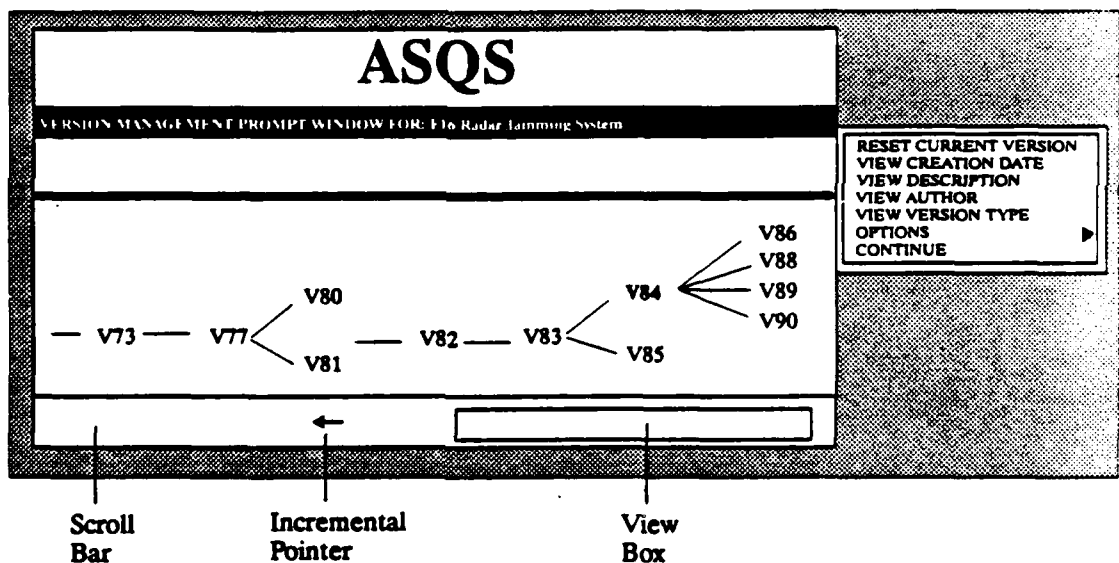
### Horizontal Scroll Bars

The lower (horizontal) scroll bar lets you shift the the document to the left and right. The side (vertical) scroll bar lets you shift the document up and down.

### View Box

The entire length of the scroll bar represents the entire length of the document. Within the scroll bar, there is a gray shaded area known as the **View Box** which tells you how much and what part of the actual document you are viewing at the present time.

The View Box in Figure 5.7, for example, indicates that approximately 2/5 of the entire Version Management Tree is currently being displayed. Its position within the scroll bar also indicates that the portion being displayed is the extreme right of the document.



**Figure 5.7 A Version Management Tree Window with a Horizontal Scroll Bar and Incremental Pointer**

### Incremental Pointer

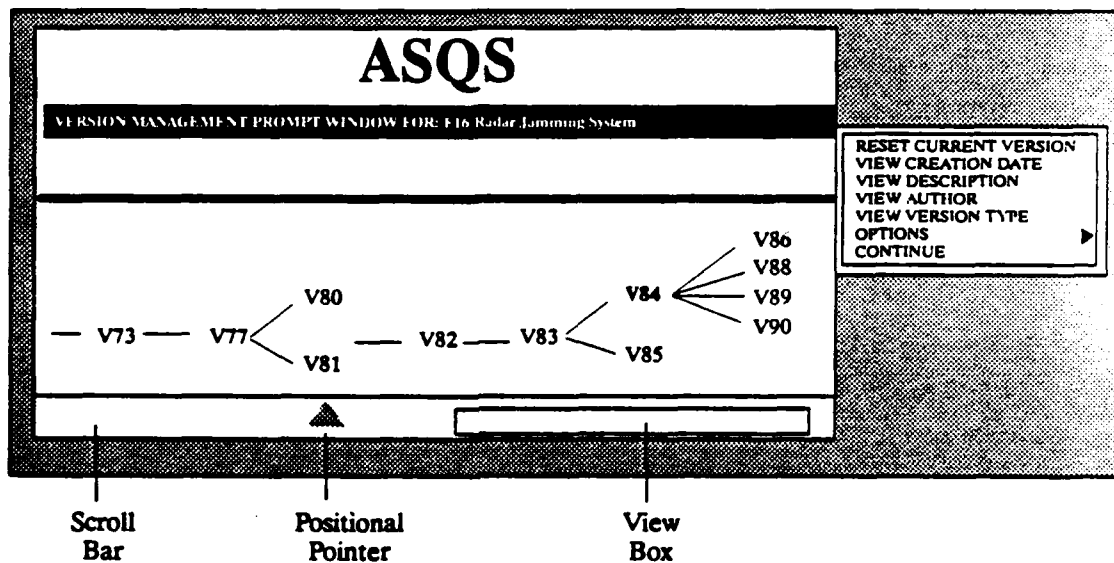
If you want to move through the window a little bit at a time, press and release the left or right mouse button according to the direction in which you want to move the document. A small black arrow, known as the **Incremental pointer** (see Figure 5.7) will appear.

The direction of the incremental pointer will tell you which way you are moving the document. If you press the mouse button and release it

quickly, the contents of the window will move a little. If you press the mouse button and hold it down, the contents will keep shifting until you release the button.

### Positional Pointer

If you know where exactly in the window you want to go, you can go there directly with the **Positional pointer** (see Figure 5.8). You will get a positional pointer by pressing the middle mouse button when the screen pointer is within a scroll bar.



**Figure 5.8 A Version Management Tree Window with a Horizontal Scroll Bar and Positional Pointer**

To get to any point in the Window, simply move the positional pointer to the area of the scroll bar approximating the area to which you want to move. (Remember that the scroll bar represents the size of the entire document.) When you release the mouse button, the window will jump to that area of the document.

### Vertical Scroll Bars

Vertical scroll bars work in a similar fashion to horizontal scroll bars. The left button slides the document up, the right button slides the document down, and the middle buttons gives you a positional pointer.

See the descriptions of ASQS Window Types, pages 5-13 through 5-22, to determine if scroll bars are available for a particular type of window.

## **The Five Major Types of ASQS Windows**

The remainder of this chapter should be used two pages at a time.

On the left hand page is a short discussion of a window type accompanied with a picture of the window. Important features of the window will be labelled with numbers.

On the right hand page are the descriptions and operational instructions for each of the numbered features. These numbered paragraphs correspond to the numbers used to label the picture of the window on the previous page.

Keep in mind that these are general descriptions of operational features. The in-depth discussions of using ASQS as a software quality specification tool are contained in Chapters 6–10.

## Roadmap Windows

The Top-level windows in ASQS are Roadmap Windows. Not only do these windows help you get quickly to the main functional areas of ASQS, they are graphically set up to give you a mental image of the relational framework of different tasks of software quality specification and assurance.

The four Roadmaps in the ASQS system are described in greater detail in Chapter 6.

The Roadmap Window's most distinctive features are:

- The graphic flowchart style layout;
- The **Path Selection Boxes**, which let you "point and click" (see below);
- An attached menu.
- The last selection made remains shaded.

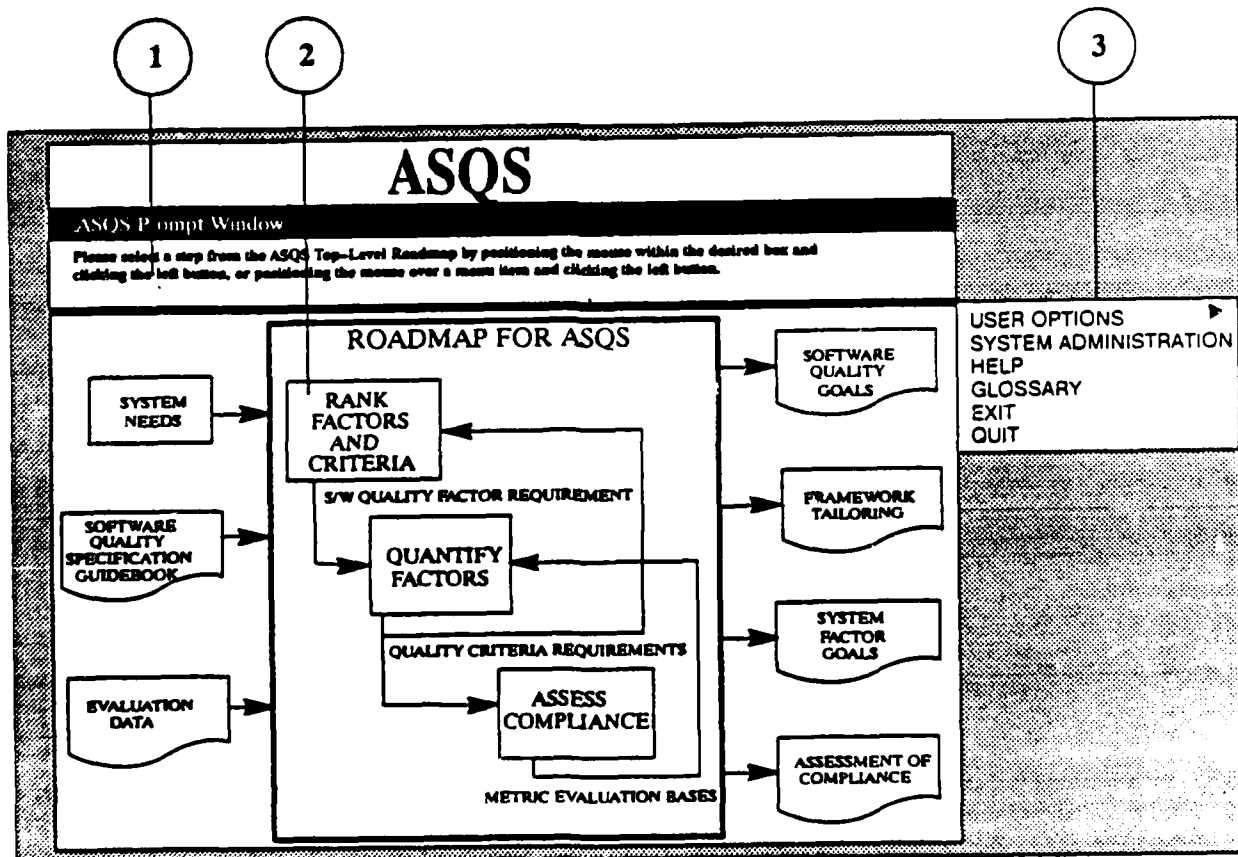


Figure 5.9 A Roadmap Window

## **Description of Features and Operations**

Roadmap Window features are labeled in Figure 5.9, and described below:

### **1. The Prompt Window**

Instructions and Help messages are displayed in this part of the Roadmap Window.

### **2. The Path Selection Box**

The Path Selection Boxes allow you to quickly access the different functions of ASQS at the top-level. To select one of the functions shown in a box, position the screen pointer on it (but not on the text), press and release the left mouse button.

To receive Help information on an option, move the screen pointer onto corresponding selection box, press and hold the left mouse button.\* The Help Message will displayed in the Prompt window.

### **3. The Attached Menu**

Many ASQS windows have option menus (and sub-menus) tacked on the side. To select one of the options, move the screen pointer onto the desired item, press and release the left mouse button.

To receive Help information on an option, move the screen pointer onto the desired item, press and hold the left mouse button.\* The Help message will be displayed in the Prompt window.

\* **Note:** In order not to select an option, the screen pointer must be moved off the box or menu before releasing the mouse button.

## Banner Windows

A very common window in ASQS is the Banner Window. The banner window has two main purposes. First, it provides you with an attached option menu for proceeding. Second, it indicates the level of ASQS that you have just entered, or the name of the project on which are working.

The Banner Window's most distinctive features are:

- The large Banner displaying the name of the current level and/or option most recently selected.
- An attached menu.

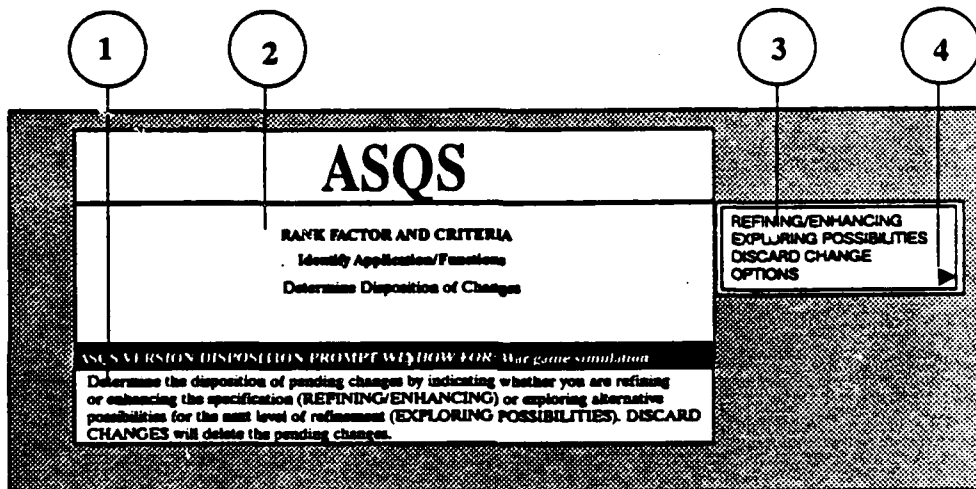


Figure 5.10 A Banner Window



## **Description of Features and Operations**

Banner Window features are labeled in Figure 5.10, and described below:

- 1. The Prompt Window**

Instructions and Help messages are displayed in this part of the Banner Window. Prompts for user input may also be displayed.

- 2. The Banner**

The title contained in this part of the banner window tells the level of ASQS which you have just entered, i.e. the Roadmap context and current step. The name of the project on which you are working may also be displayed.

- 3. The Attached Menu**

Many ASQS windows have option menus (and sub-menus) tacked on the side. To select one of the options, move the screen pointer onto the desired item, press and release the left mouse button.

To receive Help information on an option, move the screen pointer onto the desired item, press and hold the left mouse button.\* The Help message will be displayed in the Prompt window.

- 4. The Sub-Menu Indicator**

See the sections titled: The Sub-menu Indicator or the Options Sub-menu, for complete information and instructions (pages 5-5 and 5-6).

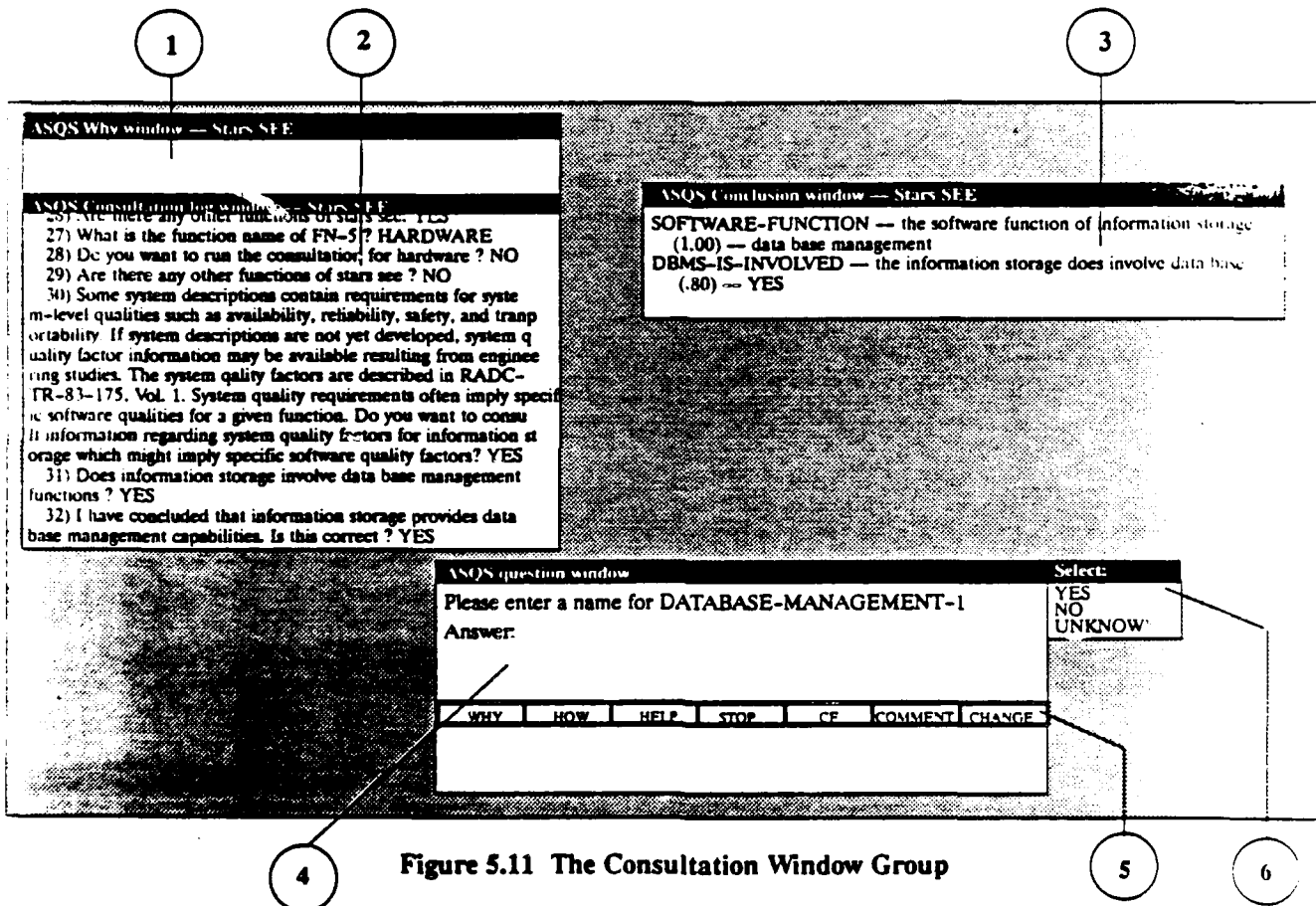
\* **Note:** In order not to select an option, the screen pointer must be moved off the menu before releasing the mouse button.

## Consultation Windows

One of the most important sets of windows in ASQS are together referred to as the Consultation Screen. The Consultation Screen is where you interactively work with ASQS to define and refine your software quality framework, and look into the web of interrelationships that define software quality goals.

The Consultation Screen's most distinctive feature is:

- Four windows (in addition to the System Prompt Window) will be opened by ASQS at once.



## **Description of Features and Operations**

Consultation Window features are labeled in Figure 5.11 and described below. For ease of viewing, all the windows in this group, except the Question Window, can be enlarged by selecting it with the left button. The font size can be enlarged by selecting the window with the middle button. Scrolling is also available.

### **1. The Why Window**

The Why Window, which is ordinarily buried under the Consultation Log Window, keeps a record of the **WHY** and **HOW** explanations which the user requested in the Question Window.

### **2. The Consultation Log Window**

The Consultation Log Window keeps a record of all the questions posed by ASQS and the answers provided by you.

### **3. The Conclusion Window**

The Conclusion Window keeps a record of all the non-trivial conclusions which ASQS has reached based on the your responses.

### **4. The Question Window**

The Question/Answer Window is where ASQS poses the current question and you provide the answer. Select the answer from the attached menu or enter it from the keyboard. Normal editing keys apply and a carriage return delimits the answer.

### **5. The Question Window Menu Strip**

The items on this menu strip may be selected by users at any time. For a detailed explanation of each item on this menu strip see Chapter 7, "Consult and Show Rankings."

### **6. Attached Answer Menu**

For questions that have an expected list of answers the user may select the answer from this attached menu rather than typing it in.

## Tree Windows

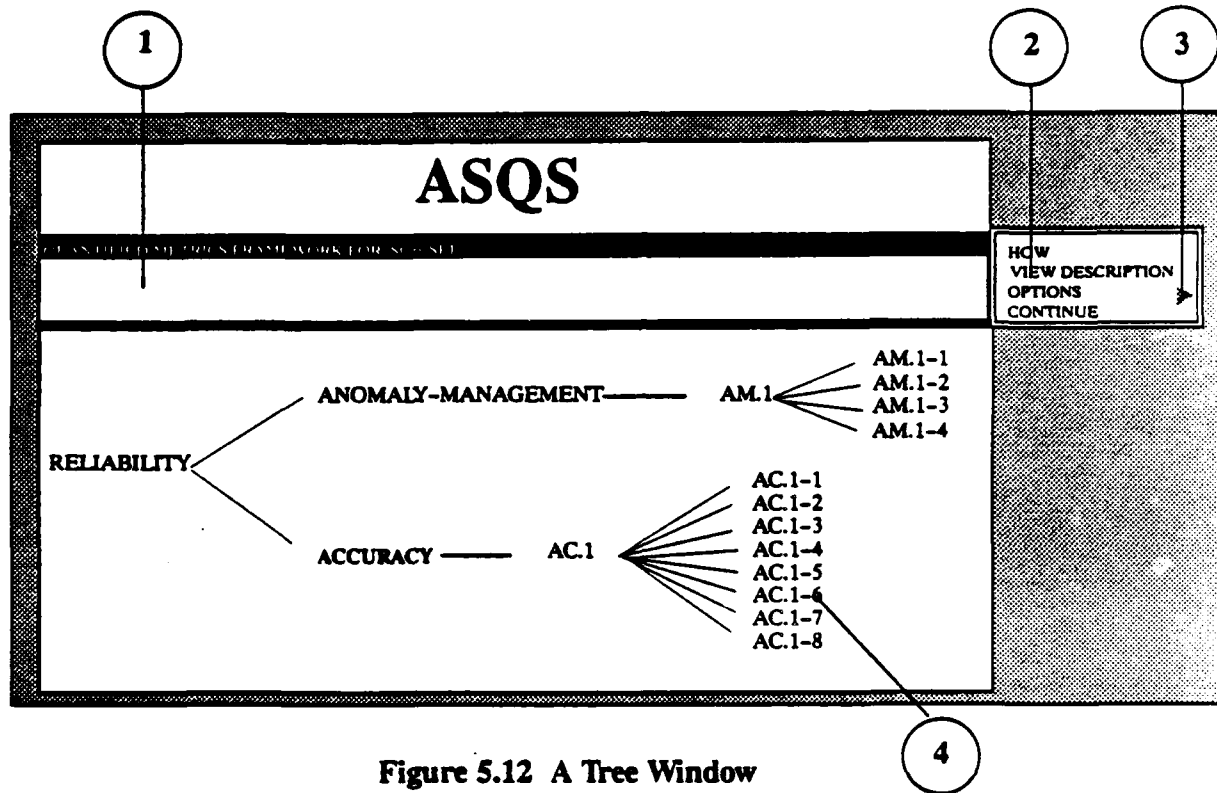


Figure 5.12 A Tree Window

The tree window shown in Figure 5.12 contains a tree structure of a tailored metrics framework. Other tree windows in the ASQS system contain tree structures of functional system decomposition, or version histories.

These tree structures serve a dual purpose.

- First, they display in a structured form information regarding the current state of the functional decomposition or the current state of the quality specification process.
- Second, they are also menus. Items in the tree structure can be selected and acted upon, or help messages and explanations regarding them obtained.

## **Description of Features and Operations**

Tree Window features are labeled in Figure 5.12 and described below. Since tree structures can grow to a considerable size, tree windows can be enlarged by selecting "Shape" from the Window Utilities Menu. This will allow you to view a much larger portion of the tree. Scroll bars are also available with this window.

### **1. The Prompt Window**

User prompts, and Help messages are displayed in this part of the Tree Window.

### **2. Attached menu**

Many ASQS windows have option menus (and sub-menus) tacked on the side. To select one of the options, move the screen pointer onto the desired item, press and release the left mouse button.

To receive Help information on an option, move the screen pointer onto the desired item, press and hold the left mouse button.\* The Help message will be displayed in the Prompt window.

### **3. The Sub-Menu Indicator**

See the sections titled: "The Sub-menu Indicator" or the "Options Sub-menu," for complete information and instructions (pages 5-5 and 5-6).

### **4. Tree Structure (Menu)**

To receive help or explanations of items in the tree move the screen pointer to the item in question, press and hold the left mouse button.

To center a tree structure item in the window, move the screen pointer to it, press and release the left mouse button.

To exercise an option from the attached menu on an item in the tree structure, select first from the menu with the left button, then select from the tree structure with the middle button.

\* In order not to select an option, the screen pointer must be moved off the menu before releasing the mouse button

## Ranking Windows

Like Tree Windows, Ranking Windows have a dual purpose.

- First, Ranking Windows provide a value matrix of rankings indicating the relative importance of quality factors for a particular function. The rankings are meant to describe the level of quality that must be obtained to fulfill the functional needs of the software. They are indicated as follows: H = High, M = Medium, L = Low. A blank, or an NA, means that the quality factor is not applicable to this particular function.

1 2 3

**ASQS**

Factor Ranking for Stars SEE

**RANK FACTORS AND CRITERIA**

Assign Factor and Criteria Rankings

SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS

HOW CONTINUE

SOFTWARE QUALITY FACTOR	PERFORMANCE					DESIGN			ADAPTATION				
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
SYSTEM OR SOFTWARE UNIQUE FUNCTION													
INTEGRATION FRAMEWORK		H	H	H		M	M	L					
INFORMATION STORAGE		H	H	H		H	M	M					

4

Figure 5.13 A Ranking Window

- Second, the Ranking Value Matrix is a menu. Values in the matrix can be selected and explanations regarding them obtained.

## **Description of Features and Operations**

Ranking Window features are labeled in Figure 5.13 and described below.

### **1. The Prompt Window**

Instructions and Help messages are displayed in this part of the Roadmap Window.

### **2. The Banner**

The title contained in this part of the banner window tells the level of ASQS which you have just entered, i.e., the Roadmap context and current step. The name of the project on which you are working may also be displayed.

### **3. The Attached Menu**

Many ASQS windows have option menus (and sub-menus) tacked on the side. To select one of the options, move the screen pointer onto the desired item, press and release the left mouse button.

To receive Help information on an option, move the screen pointer onto the desired item, press and hold the left mouse button.\* The Help message will be displayed in the Prompt window.

### **4. Ranking Value Matrix (Menu)**

To receive help or explanations of items in the matrix, move the screen pointer to the item, press and hold the left mouse button.

To receive explanations of how a ranking was determined, select with the left mouse button the particular ranking of interest.

These explanations and inferences will appear, labeled with numbers, in the Why Window.

To pursue the reasoning behind a ranking select "How" from the attached menu with the left button. A sub-menu will appear for selecting the numbered inferences requiring further explanation. (For detailed information see Chapter 7, "Show Rankings.")

\* **Note:** In order not to select an option, the screen pointer must be moved off the menu before releasing the mouse button.

## **Chapter 6**

### **ASQS Roadmaps**

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## **ASQS Overview**

Figure 6.1 shows an overview flowchart for the ASQS System. Since ASQS is an artificial intelligence tool, its functions must interact with the knowledge base. The knowledge base contains rules by which inferences are made, information on software projects and their achieved quality goals, and information on the current projects. System Administrators will regularly be updating the contents of the knowledge base as experience grows.

### **Roadmaps**

In the ASQS System, three roadmaps are used to assist you in finding your way from function to function. They serve you much the same as the roadmaps in your car assist you in finding your way from place to place.

This chapter of your user guide assumes that you are familiar with the contents of chapters 1 through 5 regarding the use of the various types of windows and menus, and the use of the Mouse.

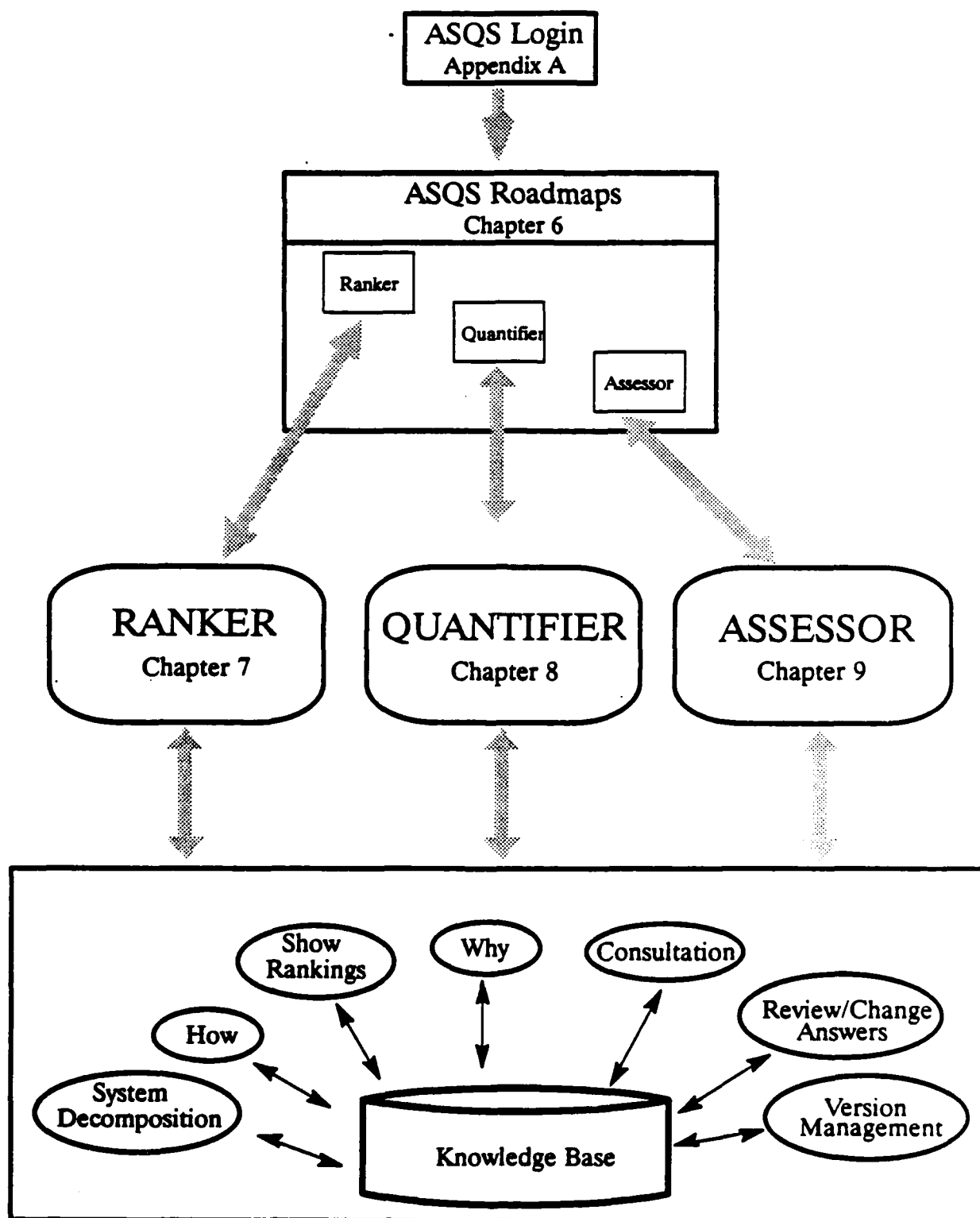


Figure 6.1 ASQS System Overview

## **The ASQS Roadmap**

The top-level roadmap in ASQS is shown in Figure 6.2. This roadmap is reached immediately upon login to ASQS, (see Appendix A.) The three main functions for the ASQS System are shown here and can be selected. The last item selected remains shaded.

### **"RANK FACTORS AND CRITERIA" (Pg 6-6)**

We will call this the RANKER. The RANKER provides assistance in: the identification and decomposition of system functions, the assigning and ranking of quality factors, revising the quality rankings based on a consideration of the interrelationships among them, and the revising of rankings based on considerations of cost. If this function is selected, a lower level roadmap, called the RANKER Roadmap, will be displayed.

### **"QUANTIFY FACTORS" (Pg 6-8)**

We will call this the QUANTIFIER. The QUANTIFIER provides assistance in: the qualification and quantification of metrics to be used in quality measurement, and in comparing the stated quality goals with data from other similar projects. If this function is selected, a lower-level roadmap called the QUANTIFIER Roadmap will be displayed.

### **"ASSESS COMPLIANCE" (Chapter 9)**

We will call this the ASSESSOR. The ASSESSOR provides assistance in determining the degree to which software complies with the stated quality goals. The ASSESSOR does not have a Roadmap.

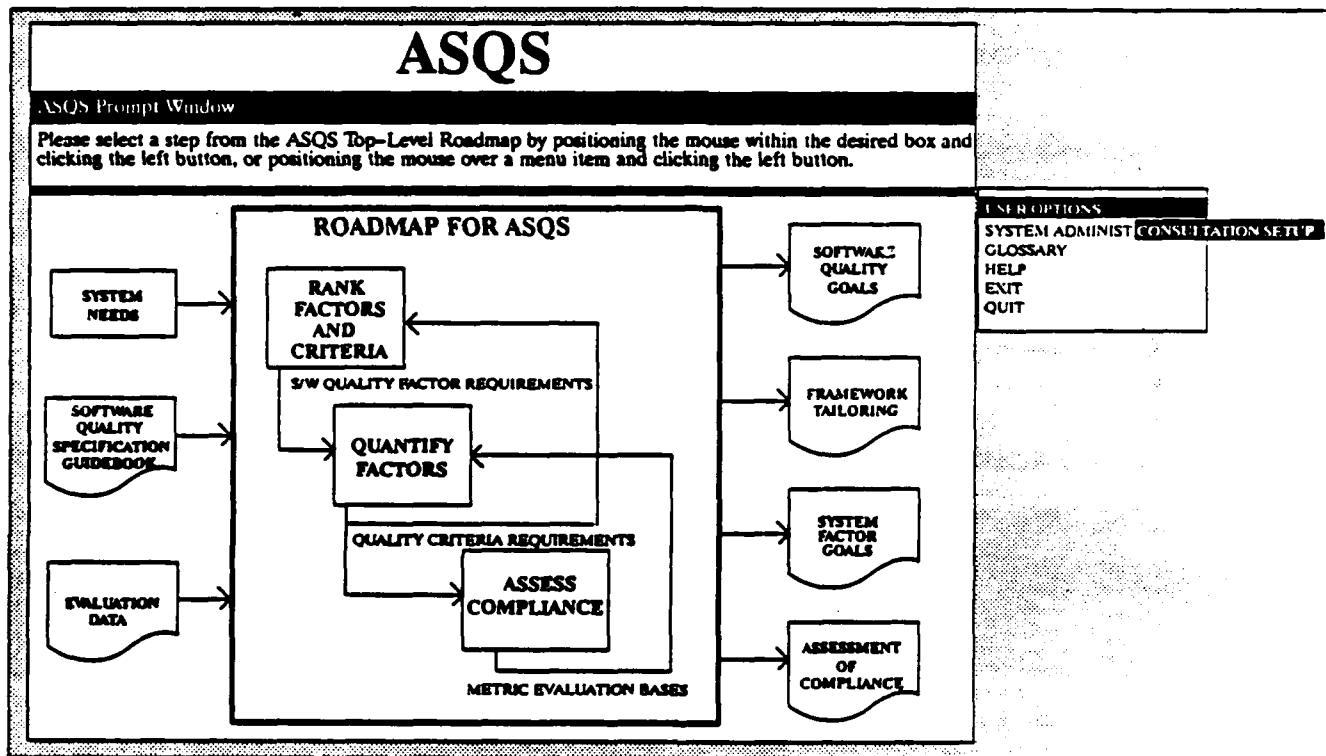


Figure 6.2 The Main ASQS Roadmap

## The ASQS Roadmap Attached Menu

The list to the right of the ASQS Roadmap is an attached menu of selections for operations you may choose before you begin your consultation session or to perform other activities related to the system.

### User Options

The choice "User Options", shown in Figure 6.2 accesses the choice "Consultation Setup". Selecting Consultation Setup opens the Consultation Options Setup Window, shown in Figure 6.3. In this window, you can set the default window size, screen placement, and font size for three windows opened automatically during a consultation as part of the Consultation Screen. Each consultation window has two primary font and window sizes, large and small. You can switch between the two by using the left and middle mouse buttons during the consultation as a toggle between the sizes. This function is useful during a consultation, when you are paying attention to the contents of one of the consultation windows rather than the others and would like to enlarge it for easy reading (and reduce the size of the other windows to save screen space).

QUESTION LOG WINDOW				
SMALL SIZE	LARGE SIZE	LOCATION	DEFAULT FONT	DEFAULT SIZE
WIDTH: 550 HEIGHT: 150	WIDTH: 550 HEIGHT: 350	X: 30 Y: 5	LARGE	SMALL LARGE

CONCLUSION LOG WINDOW				
SMALL SIZE	LARGE SIZE	LOCATION	DEFAULT FONT	DEFAULT SIZE
WIDTH: 550 HEIGHT: 150	WIDTH: 550 HEIGHT: 350	X: 615 Y: 5	LARGE	SMALL

HOW/WHY LOG WINDOW				
SMALL SIZE	LARGE SIZE	LOCATION	DEFAULT FONT	DEFAULT SIZE
WIDTH: 550 HEIGHT: 150	WIDTH: 550 HEIGHT: 350	X: 30 Y: 35	SMALL	SMALL

Figure 6.3 The Consultation Options Setup Window

To change the default font or window size from the setup window, select the item you want to change to access the pop-up menu, shown for the Question Log Window default size option. Highlight the new size and release the mouse button. To change the default window placement of any of the three consultation windows, select the current setting with the left mouse button and then type in a number for a new value. When you have finished changing selections, click on Done (at the top of the window) to return to the top-level Roadmap.

#### **System Administration (Appendix D)**

This option accesses a group of options which varies according to the privileges of the user. Normal users would select System Administration to Change their own Passwords and Accessing the a Project List. ASQS System Administrators access these functions to Add and Delete Users, and to Access Mission Area and Project Lists for setting privileges for users. Complete descriptions of System Administration functions are provided in Appendix D.

#### **Help**

This option accesses context-sensitive help on the current window.

#### **Glossary**

This option accesses the on-line glossary (discussed in Chapter 5).

#### **Exit**

Select this to exit the system and save the changes made to a software specification.

#### **Quit**

Select this to quit the system without saving any changes.

## **The Ranker Roadmap**

Figure 6.4 shows the Ranker Roadmap, which is reached by selecting **Rank Factors and Criteria** from the ASQS Roadmap. The four main functions of Ranker are shown in selection boxes.

### **"IDENTIFY APPLICATION/FUNCTION" (Pg 7-3)**

This is typically step one of a Software Quality Specification effort. Different system functions and the software supporting these functions will likely have different quality needs. This function of the Ranker will assist you in identification and decomposition of your software system and its functions so that separate quality requirements can be specified for each.

### **"ASSIGN FACTORS AND CRITERIA RANKINGS" (Pg 7-13)**

Once software functions have been identified, the various quality factors important to each must be assigned and given an initial ranking of its relative importance. This function of the Ranker will consult with you regarding the specific characteristics and needs of your software functions and assist you in setting the initial quality rankings. This function also allows you to change answers given to ASQS in a previous consultation or survey.

### **"REVISE RANKINGS BASED ON INTERRELATIONSHIPS" (Pg 7-31)**

Assigning more than one quality factor to a function can have a beneficial or an adverse effect, depending on the combination of factors that have been assigned. This function of the Ranker will consult with you regarding shared criteria, beneficial and adverse relationships and the quantification of these relationships. It will then assist you in reviewing current quality goals by proposing and/or performing adjustments to the current rankings.

### **"REVISE RANKINGS BASED ON COST" (Pg 7-33)**

Relative cost of a specific quality factor varies over the software life cycle. This function of the Ranker will consult with you regarding the applicable quality factors for a function and the impact on cost during various stages of the life cycle. It will then assist you in identifying goals that may be excessively costly or impossible to achieve as a result of cost constraints stemming from relationships between conflicting goals.

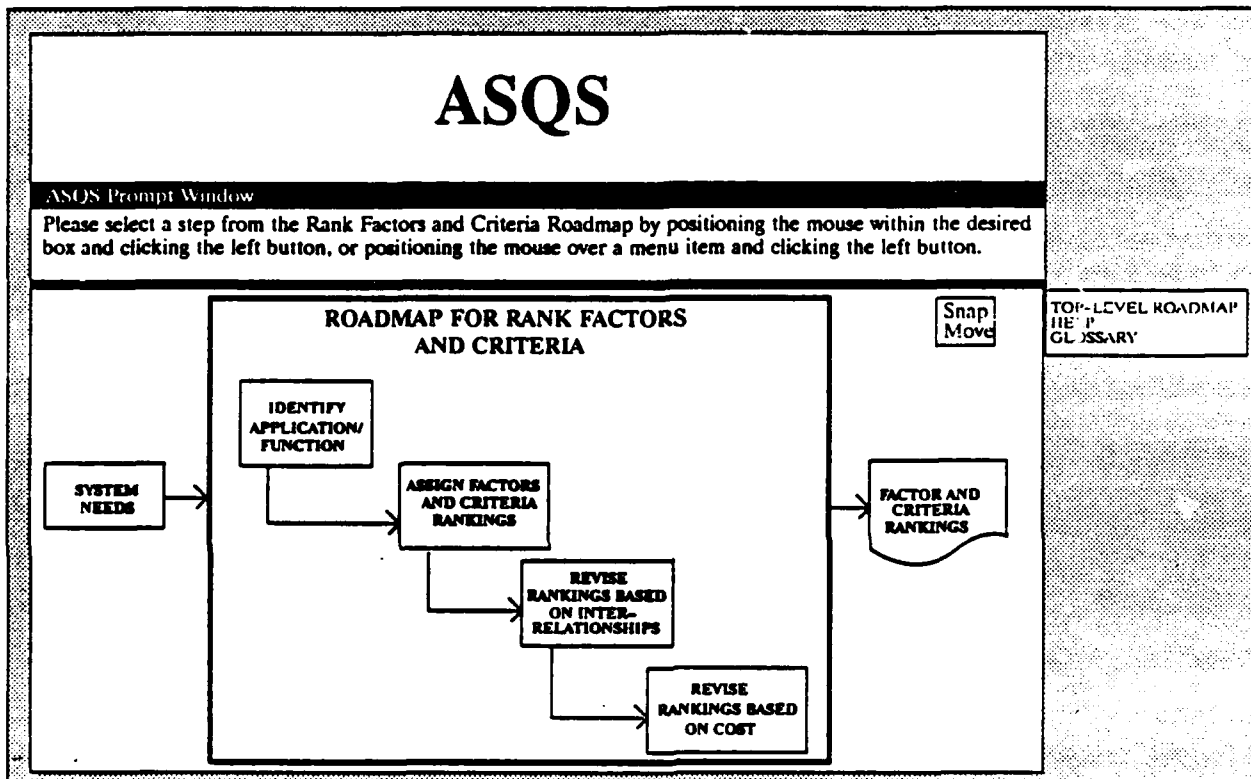


Figure 6.4 The Ranker Roadmap



## **The Quantifier Roadmap**

Figure 6.5 shows the Quantifier Roadmap, which is reached by selecting "Quantify Factors" from the ASQS Roadmap. The three main functions of the Quantifier are shown in selection boxes.

### **"QUALIFY METRICS" (Pg 8-2)**

Select for measurement the specific software quality criteria and their appropriate metric elements most relevant to the system being considered. During this step, more consultation is necessary to further refine the quality specification. The primary output of this effort is a tailored quality metric framework. For each quality factor, this framework indicates the specific metric elements that are applicable.

### **"QUANTIFY METRICS" (Pg 8-7)**

This function will run a consultation session specifically regarding quality metrics in order to establish a baseline, or expected range of scores for the quality metrics, criteria and factors in the tailored framework.

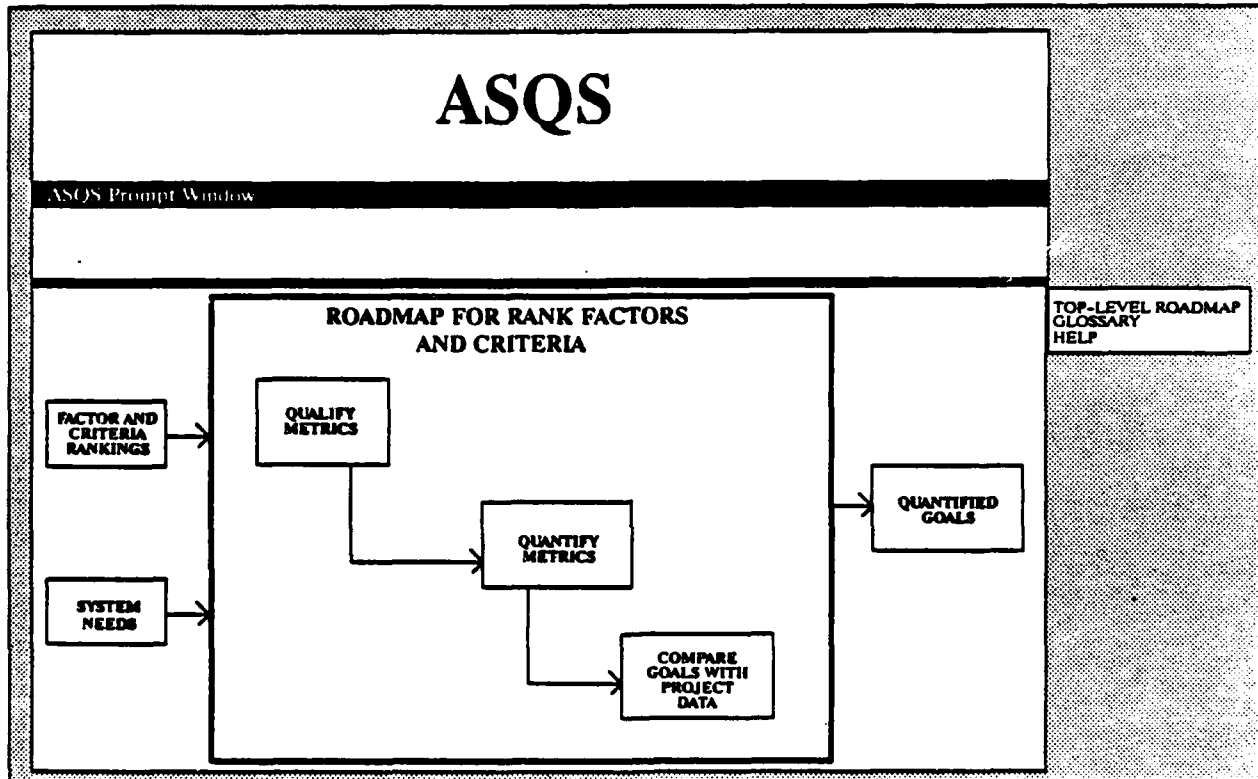


Figure 6.5 The Quantifier Roadmap

## Chapter 7

### Rank Factors

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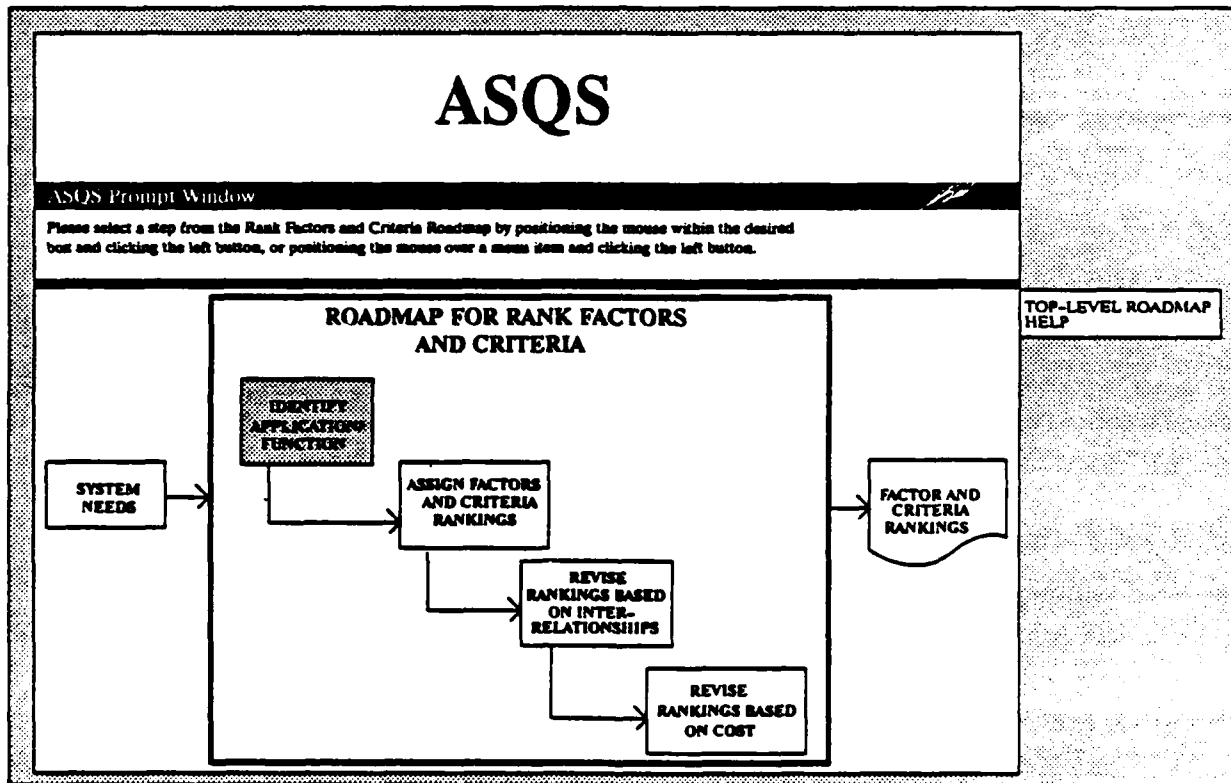
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To reach the Ranker Roadmap (shown in Figure 7.1), the user must select "Rank Factors and Criteria" from the main ASQS Roadmap (see p. 6.2).

### Identify Application/Function

The logical first step within the Rank Factors and Criteria window is selecting the Identify Application/Function as shown in Figure 7.1. The specific project being considered is identified here and system decomposition can be done here also.



**Figure 7.1 Selecting the Identify/Application Function**

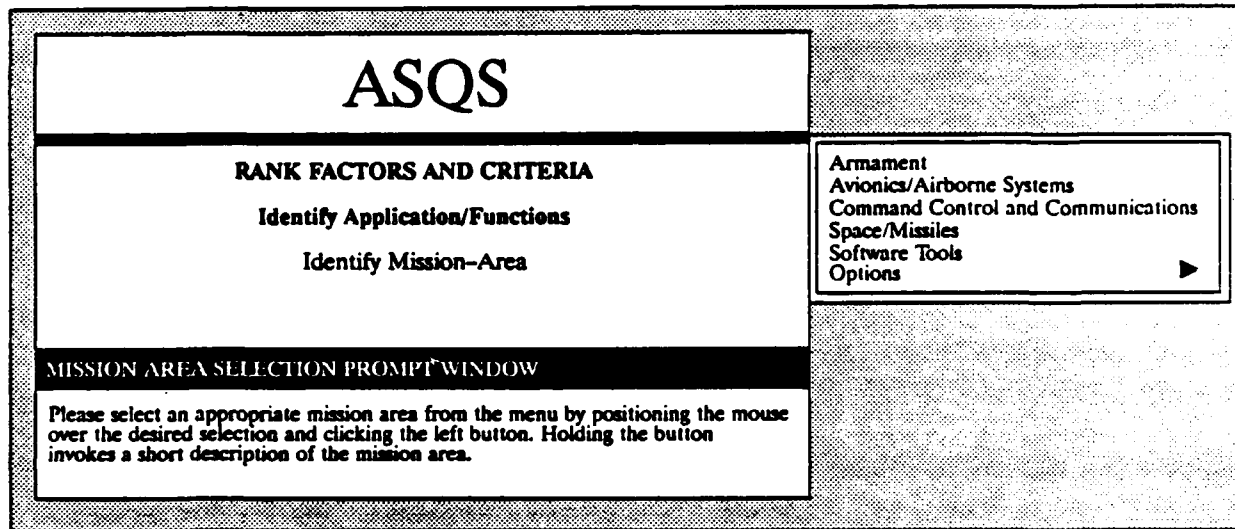
Whether the user is creating a new project, or doing further exploration of an existing project, the following first three steps are required:

1. Identify Mission Area
2. Identify Software Type
3. Identify Project

ASQS must have this identification before any other functions of the System can be used. The following three pages describe how to perform these three steps.

## 1. Identify Mission-Area

Once the user has selected the Identify Application/ Function, the window for Identifying Mission Area will appear as indicated in Figure 7.2. In this window, the user can select the appropriate mission area from the attached menu. The user can only select from the mission areas available on the menu, which are the ones the System Administrator has granted the user access privileges for. Users can have privileges of "own", "read", "write", or no access, depending on need, for a given mission area.



**Figure 7.2 Identify Mission-Area Window**

**Own** – gives the user the privilege of creating projects in a Mission Area, using Add Project option.

**Read** – gives the user the privilege of reading and browsing material in a Mission Area.

**Write** – gives the user the privilege of reading and browsing files and making changes to the software quality specification.

**No access** – the user will not see a Mission Area listed on the menu.

Access privileges to Mission Areas are a necessary prerequisite to access privileges for Projects.

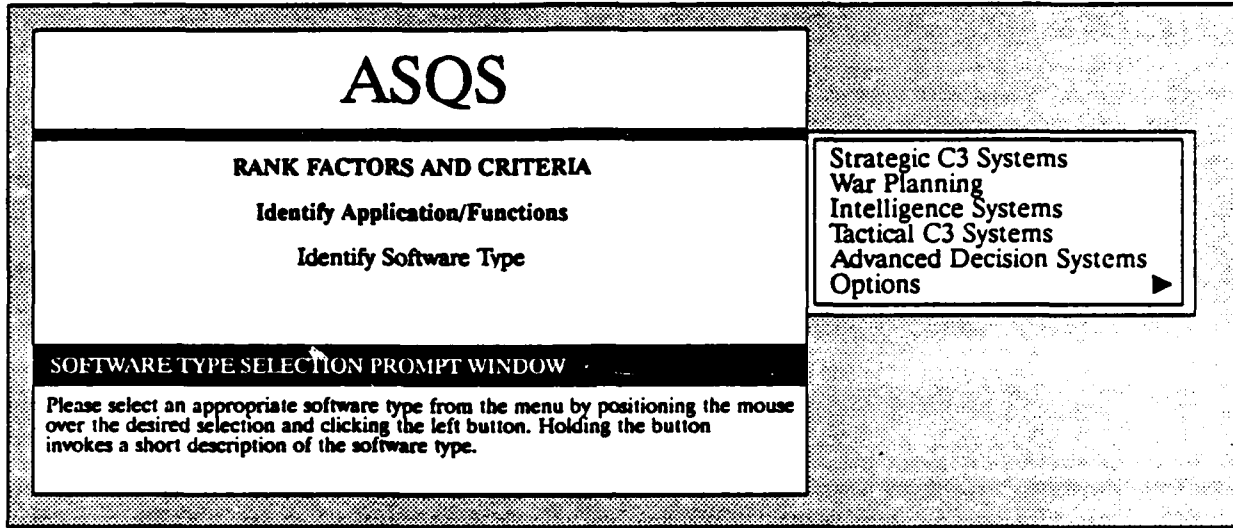
The identification of a specific Mission Area is important because the ASQS knowledge base contains information about the particular characteristics, functions and quality needs associated with different mission areas. Therefore, ASQS may already know a considerable amount about your project once you have identified a Mission Area.

Options, with a sub-menu of Roadmap, Glossary, and Previous Step, are also provided on the attached menu (see p. 5-6).

In addition, the user can invoke a short description of each Mission Area by holding the left mouse button without releasing it, over each selection on the menu. Each Mission Area has a unique screen background to identify to the user which Mission Area is in use. This bit-map background stays in place until a new Mission Area is selected.

## 2. Identify Software Type

When the user makes a selection from the Mission Area window, the Identify Software Type window will appear. The user can select the appropriate software type from the attached menu. The list of relevant available software types is unique to each Mission Area. The example shown in Figure 7.3 shows the software types available under the Mission Area Command Control and Communications.



**Figure 7.3 Identify Software Type Window**

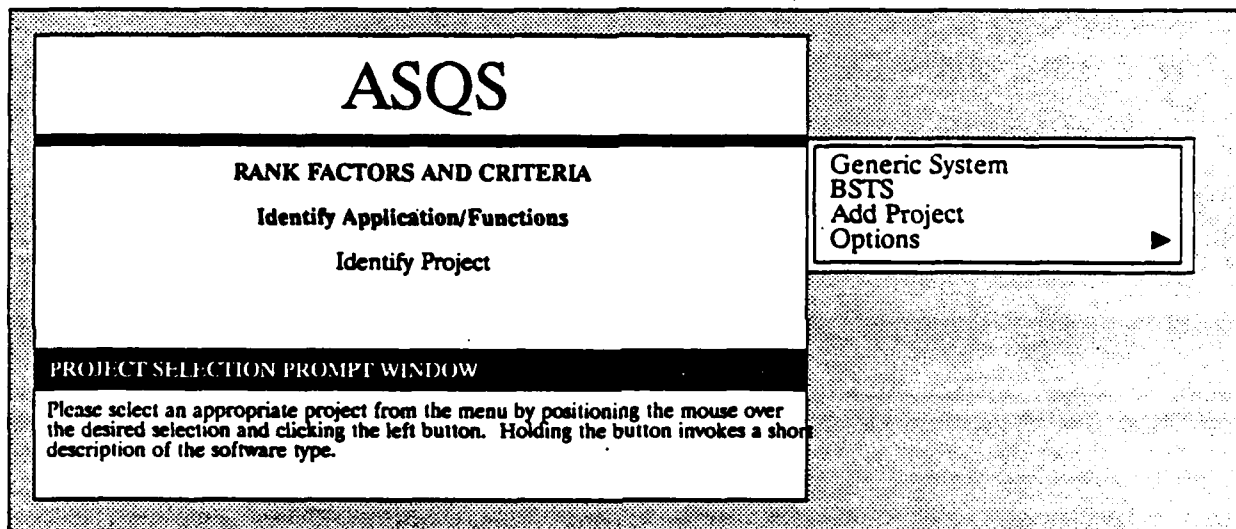
This identification of a software type is important because the ASQS knowledge base contains information about the particular characteristics, functions and quality needs associated with different software types. Therefore, ASQS may already know a considerable amount about your project once you have identified a software type.

An Options sub-menu is also provided.



### 3. Identify Project

Once a selection is made from the Software Type window, the Identify Project window follows. Figure 7.4 is an example. The attached menu contains a list of projects that have been added to ASQS under this mission area and software type for which the user has at least "read" access. The grouping of projects in this manner allows the user to review other similar projects for insight into relevant issues. If users have "write" access to a project, they will be able to make changes to the specification. If the user has "own" access within the Mission Area, and is creating a new project, "Add Project" should be selected and prompts will assist the user in entering a new project name and description. The System Administrator grants permission for "read," "write," and "own" access to Mission Areas and projects (see Appendix D System Administration).



**Figure 7.4 Selecting in the Identify Project Window**

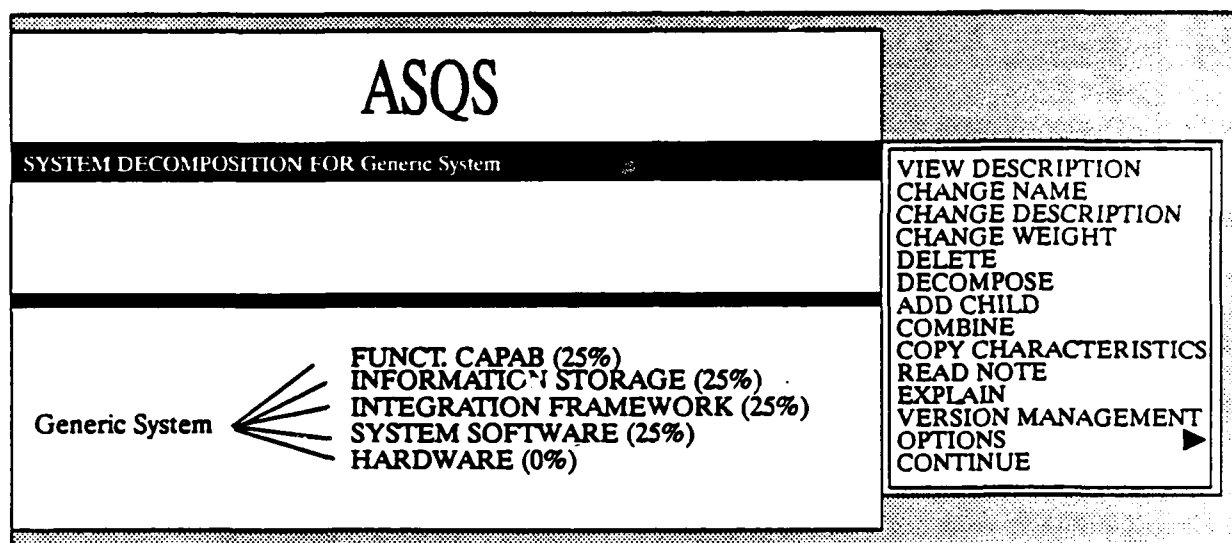
A Generic System is available for some of the software types. The generic system provides a generalization of a project of that software type which may be used for review, or as an available source of relevant characteristics and decompositions.

The user can invoke a short description of any project on the attached menu by pressing and holding the left mouse button with the screen pointer over the selection of interest.

An Options sub-menu is also provided.

## System Decomposition

After the project identification step above, the System Decomposition window appears. Figure 7.5 is an example of a System Decomposition window.



**Figure 7.5 System Decomposition Window**

In this step, the user identifies each function that has separate quality requirements. This need not be done immediately at the beginning of a new project. It is recommended that this be done in stages as the understanding of the new system grows. Certain guidelines such as cost, level of required resolution, and logical system decomposition should be considered when identifying the functions. If too many functions are identified, then the evaluation process becomes too costly. If too few functions are identified, then sufficient quality concerns may be overlooked. To perform system decomposition, select Decompose from the attached menu (see description of this function).

There are fourteen selections on this attached menu from which to choose. The Assistant allows the user to execute the various selections as described below.

**View Description** allows the user to choose a function node from the Decomposition Tree (lower-left window) and provides a brief description of it.

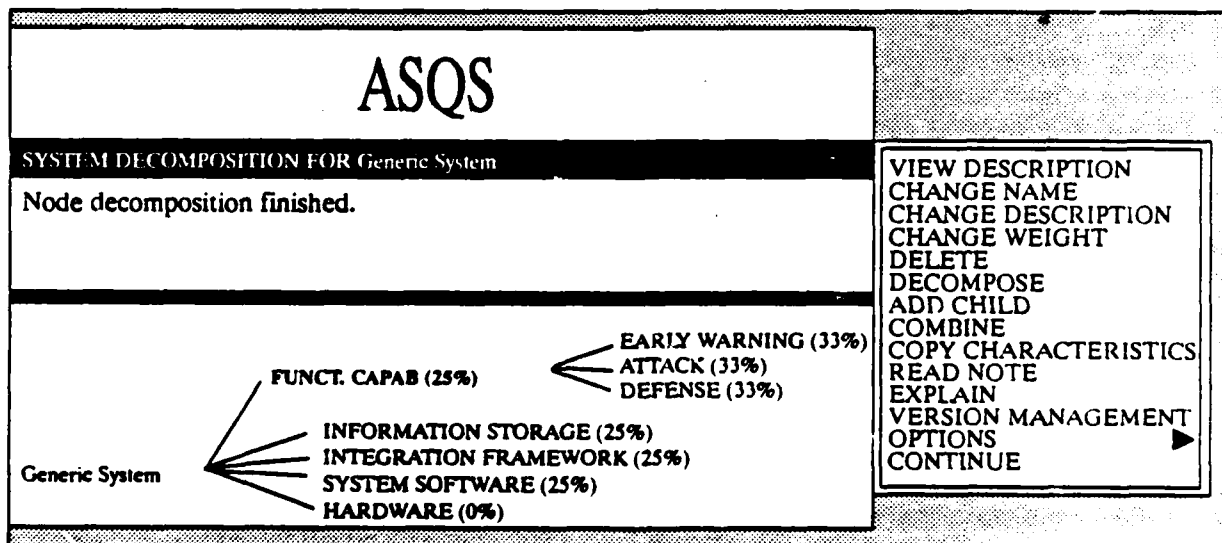
**Change Name** allows the user to change the name of a node in the Decomposition Tree by first selecting the node and then adding a new name.

**Change Description** allows the user to change the functional description of a node from the Decomposition Tree.

**Change Weight** enables the user to change the weighted value (number from 0–10 in parenthesis) of a function node from the Decomposition Tree. This number is an indication of the relative value of this leaf (or child) to the parent. These weighting numbers are used by ASQS to calculate the percentages displayed in the decomposition window. When calculating the factor and criteria rankings for a parent node, the rankings of the children are used and weighted according to the percentage. The default weight is 1.

**Delete** allows the user to delete a selected node from the Decomposition Tree. Then, the system will recalculate the percentage weightings based on the weighted values among the remaining nodes. Only leaves can be deleted. When the last leaf (or child) of a parent is deleted, the parent inherits the characteristics of the deleted child.

**Decompose** allows leaves of the Decomposition Tree to be broken out into more leaves. (If one wishes to further decompose a parent, “Add Child” will have to be selected.) After a function is selected for decomposition, the prompt window asks for a name and description of the “child” (subfunction) to add to the existing function node. ASQS will keep prompting for names and descriptions of additional children until the user enters only a carriage return in response to the prompt for a new name. Once this step is accomplished, ASQS completes the decomposition with the appropriate weightings equally distributed according to the number of “children” created, (see Figure 7.6). The characteristics of these new children are copies of the parent’s characteristics.



**Figure 7.6 The Decomposition of a Function**

**Add Child** allows the user to add a new subfunction of an existing node on the Decomposition Tree. Unlike “Decompose”, children added with this option receive no characteristics, unless they are the first child to be added to that node. Users need either to “Copy Characteristics” or run

a consultation in order to get characteristics for the new node. The system will also reassign the weighting values evenly among the combined "children", provided the user has not changed the weightings.

**Combine** permits the user to choose a pair of nodes and combine them together as one. Both children (or leaves) must belong to the same parent. The new combined node will receive the higher of the weighting values of the two nodes that were combined. For characteristics that were the same but had different certainty factors (CF), the lower CF will be kept. For characteristics that are different, no characteristics will be kept and the user must run a consultation to answer questions regarding those characteristics.

**Copy Characteristics** enables the user to copy the characteristics from one node of a project, selected from the **Identify Mission-Area** window, to another node on another project. Users are allowed to select which characteristics are to be copied from the **Select Characteristics** window, e.g. functional characteristics, environment characteristics, etc. Characteristics can be copied only to and from leaves, or nodes, of the decomposition tree. If any of the characteristics being copied already exist in the destination node, the copy will not be performed for those characteristics. Users can also copy Project characteristics, representing the project as a whole, between projects. (See p. 7-11)

**Version Management** acts as a "Project Historian". It allows the user to view different versions of the quality specification, or to change the current version (see p. 7-14).

**Options** provides a standard Options sub-menu (see p. 5-6).

**Continue** takes the user to the next step of the process, which is **Disposition of Changes**, if any changes are pending (see p. 7-15). Otherwise, the next step of the process is the **Ranker Roadmap**.

## Copy Characteristics

In order to Copy Characteristics between nodes of the same project, users must first have created characteristics for the functions through a consultation session and saved a version of the specification by exiting from the system (this causes consultation results to be saved). Users can also use Copy Characteristics to move Project Characteristics from one Project to another. This may take a while if the characteristics of a large project are copied. Project characteristics are stored for a project as a whole, regardless of the level of decomposition.

To use this function, select Copy Characteristics from the System Decomposition menu. You will then identify the project you are copying characteristics from, using the same process as identifying your own project. The system prompts you to identify the Mission Area, Software Type, and Project from which and to which you are copying characteristics. (See Figure 7.7 for the Identify Mission Area screen).

**ASQS**

**RANK FACTORS AND CRITERIA**

Identify Application/Functions

Copy Characteristics From...

Identify Mission Area

**MISSION AREA SELECTION PROMPT WINDOW**

Please select an appropriate mission area from the menu by positioning the mouse over the desired selection and clicking the left button. Holding the button invokes a short description of the mission area.

Armament  
Avionics/Airborne Systems  
Command Control and Communications  
Space/Missiles  
Software Tools  
Options

**Figure 7.7 The Copy Characteristics Screen Asking for Identification of Mission Area**

When you identify the project to copy from, ASQS gives you a system decomposition window for that project (see Figure 7.8). The Copy Characteristics function allows you to copy from different versions as specified by the project's Version Management function. You would select version management from the menu on the System Decomposition window to select a specific version. Select Continue when done. ASQS returns you to the System Decomposition window for your project, where you select either Select Functions or Copy Project Characteristics Only.

If you select function characteristics, you get an additional menu asking you which functions to copy to, which you identify for your project. When you identify these functions, or have selected Project Characteris-

<h1 style="margin: 0;">ASQS</h1>	
<b>SYSTEM DECOMPOSITION FOR Generic system</b> De-select nodes from the tree with the middle button.	SELECT FUNCTIONS DE-SELECT FUNCTIONS COPY PROJECT CHARACTERISTICS ONLY OPTIONS VERSION MANAGEMENT CONTINUE
<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">Generic System</div> <div style="margin-left: 10px;"> <p>FUNCT. CAPAB (25%)</p> <p>INFORMATION STORAGE (25%)</p> <p>INTEGRATION FRAMEWORK (25%)</p> <p>SYSTEM SOFTWARE (25%)</p> <p>HARDWARE (0%)</p> </div> </div>	

**Figure 7.8 System Decomposition window for GENERIC SYSTEM for Copy Characteristics Function**

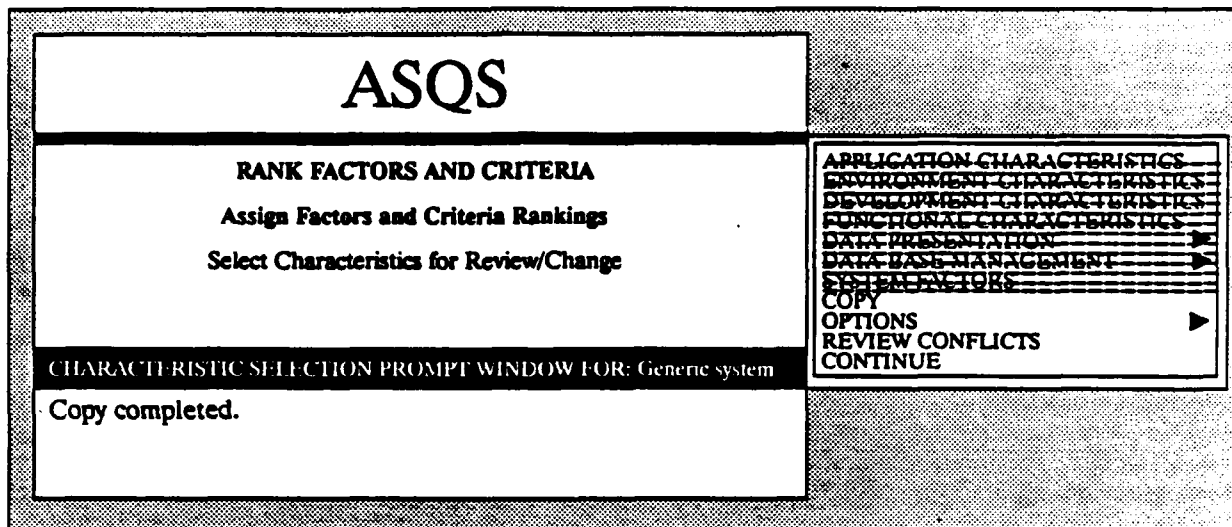
tics Only, you access a screen to pick classes of functions. (See p. 7-20 for a description of these classes of characteristics.)

Select as many classes as are applicable to your copy task. Your choices will be highlighted (see Figure 7.9 and 7.10)

Then select Copy from the same menu. The system returns a prompt of Copy Completed when it is through.

<h1 style="margin: 0;">ASQS</h1>	
<b>RANK FACTORS AND CRITERIA</b> Assign Factors and Criteria Rankings Select Characteristics for Review/Change	APPLICATION CHARACTERISTICS ENVIRONMENT CHARACTERISTICS DEVELOPMENT CHARACTERISTICS FUNCTIONAL CHARACTERISTICS DATA PRESENTATION DATA BASE MANAGEMENT SYSTEM FACTORS COPY OPTIONS REVIEW CONFLICTS CONTINUE
CHARACTERISTIC SELECTION PROMPT WINDOW FOR: Generic system Select characteristics to copy.	

**Figure 7.9 Select Characteristics for Copy Characteristics**



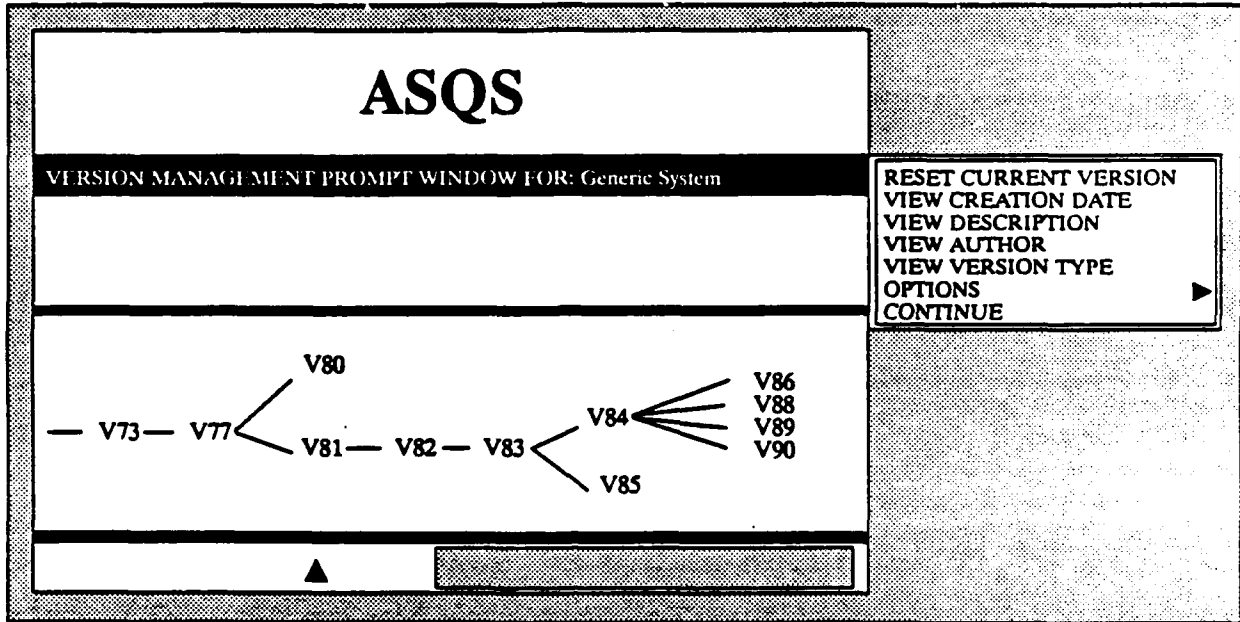
**Figure 7.10 Highlighting of Selections Shows Which Classes You Have Selected for Copy Characteristics**

After you complete this task, select Continue from the option menu. ASQS returns you to the System Decomposition Window for your own project. If you want to continue to Copy Characteristics, you may do so by selecting **Previous Step** from the **Options** submenu until you return to selecting **Copy Characteristics** again (twice or once, depending on whether you completed copying function characteristics or project characteristics).

After you Copy Characteristics, you will want to “tweak” your answers. This is done in the Review/Change Answers option from the Ranker Menu.

## Version Management

**Version Management**, selected from the System Decomposition menu, allows the user to view a history of various versions of the software quality specification (see Figure 7.11).



**Figure 7.11 Version Management Prompt Window**

**Reset Current Version** allows the user to specify which version of the specification to use as the current operative version.

**View Creation Date, View Description, View Author, View Version Type:** all of these choices allow the user to see information about the versions in the Version Management window. Users must select first from the menu and then they will be prompted to select a version from the Version Management Window.

**Options** provides a standard Options sub-menu (see p. 5-6).

**Continue** takes the user back to the point where Version Management was selected, which varies with the phase of consultation the user is in.



## Determine Disposition of Changes

Whenever changes are pending, ASQS may display the Version Disposition Window, shown in Figure 7.12. Since changes are not saved automatically as a new version, users must select from the attached menu what is to be done with the changes.

**ASQS**

**RANK FACTORS AND CRITERIA**

Identify Application/Functions

Determine Disposition of Changes

**REFINING/ENHANCING  
EXPLORING POSSIBILITIES  
DISCARD CHANGES  
OPTIONS** ►

**ASQS VERSION DISPOSITION PROMPT WINDOW FOR: Generic System**

Determine the disposition of pending changes by indicating whether you are refining or enhancing the specification (REFINING/ENHANCING) or exploring alternative possibilities for the next level of refinement (EXPLORING POSSIBILITIES). DISCARD CHANGES will delete the pending changes.

**Figure 7.12 Disposition of Changes Window**

**Refining/Enhancing** saves the changes to the specification and creates a new current working version and number. When you select this option, ASQS asks you two questions, for which you must type answers. First, the system will record why you are refining the specification, and next, in response to the prompt, describe the extent of the changes made since the last disposition of changes.

**Exploring Possibilities** saves the changes to the specification and creates a new version number. However, this new version will not become the current working version. This selection is used to do "what if..." analysis to see the impact of changes on quality goals. When you select this option, the system asks why you are exploring possibilities and then for a description of the changes made since the last Disposition of Changes. When you select this option, ASQS creates a new version of the specification and resets the current working version back to the previous version of the specification.

**Discard Changes** deletes the pending changes, leaving the previous version as the working version.

**Options** provides a standard Options sub-menu (see p. 5-6).

At the completion of this step, ASQS continues the user's selected processing sequence, depending on where in a session the user needed to make a Disposition of changes. For example, if you selected Version

Management functions from the Version Management Window and ASQS requested a Disposition of Changes, then you would be returned to that window.

## Assign Factors and Criteria Rankings

Once a system has had its functions identified and decomposed, quality specifications can then be developed. Assigning quality factors and initial rankings is the next step. Select the Assign Factors and Criteria Rankings function from the Ranker Roadmap (see Figure 7.13).

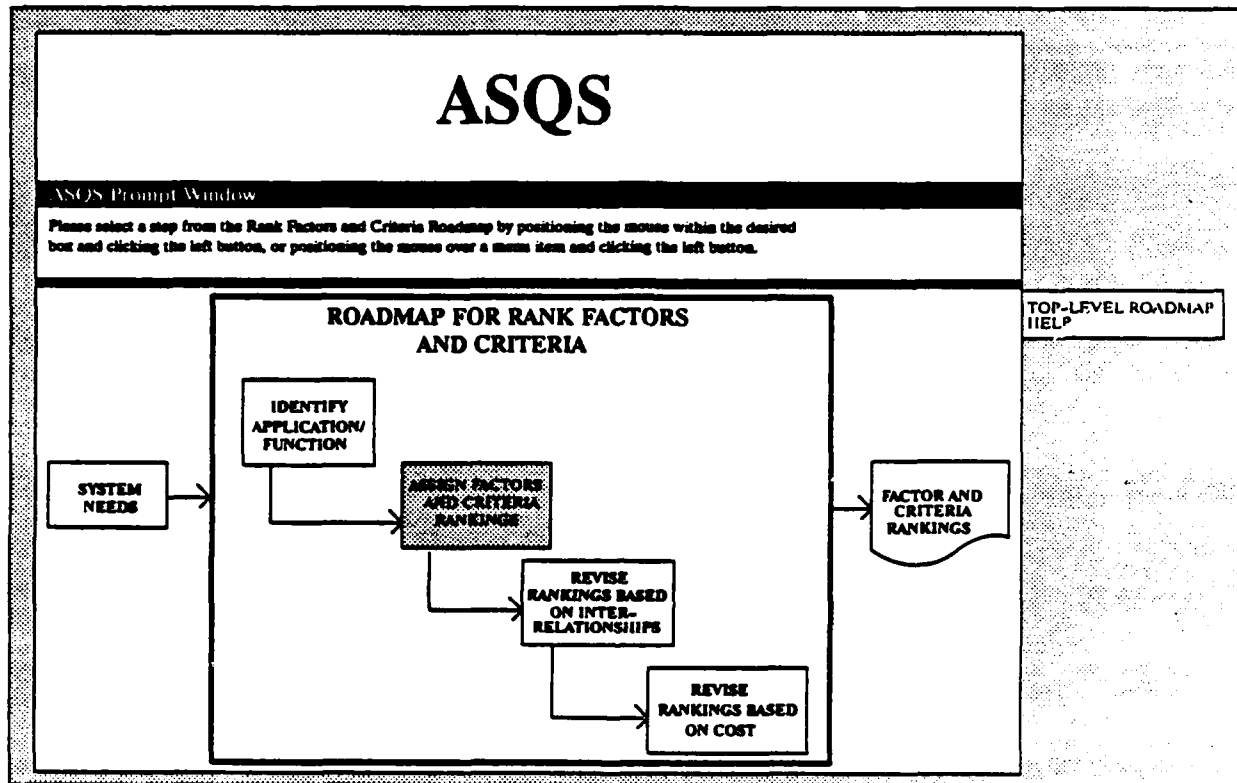
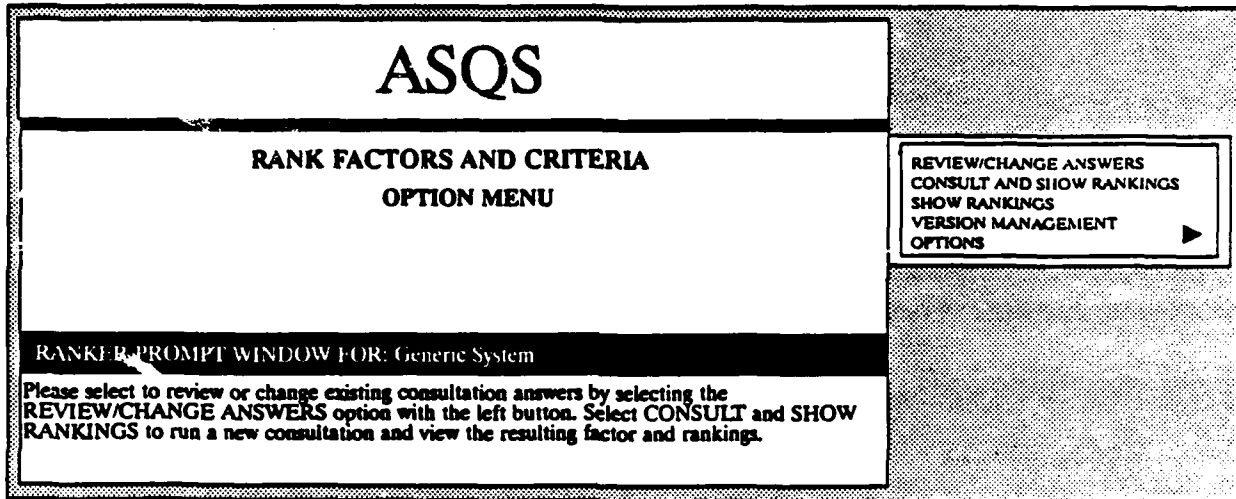


Figure 7.13 Selecting "Assign Factors. . ."

The ASQS System requires that a specific project be identified as the one currently under consultation. If, since login, the user has not identified to the ASQS System which project is under consideration, this will have to be done prior to using the Assign Factors and Criteria Rankings function. Simply return to Identify Application/Function and perform the first three steps: Identify Mission Area, Identify Software Type, Identify Project.

## Ranker Option Menu

Figure 7.14 shows the Ranker Option Menu, which appears when "Assign Factors and Criteria Rankings" is selected from the Ranker Roadmap. The options on the attached menu are as follows:



**Figure 7.14 Rank Factors Option Window**

**Review/Change Answers** allows the user to selectively review consultations and change any answers given during previous consultations. (See page 7-19.)

**Consult and Show Rankings** allows the user to run a new consultation and view the resulting rankings. (See page 7-25.)

**Show Rankings** will display the current quality factor rankings. (See page 7-39.)

**Version Management** displays the Version Management Window. These functions are discussed on page 7-14.

**Options** provides the standard Options Sub-menu of Roadmap, Glossary, Help, Previous Step.

### Review/Change Answers

To review or change answers from a previous consultation, select Review/Change Answers from the Ranker Option Menu. This process requires three steps:

1. Select functions for review.
2. Select characteristics for review.
3. Review and/or change the answers.

The select functions screen is shown in Figure 7.15. This screen allows the selection and de-selection of specific functions for review. In addition, the standard Options menu is provided. The user should select first from the menu, then select from among the functions. Selecting a parent selects all of the children.

ASQS

SYSTEM DECOMPOSITION FOR Generic System

Select applicable functions.

Generic System

- FUNCT. CAPAB (25%)
- INFORMATION STORAGE (25%)
- INTEGRATION FRAMEWORK (25%)
- SYSTEM SOFTWARE (25%)
- HARDWARE (0%)

SELECT FUNCTIONS  
DE-SELECT FUNCTIONS  
OPTIONS  
CONTINUE

Figure 7.15 Selection of Functions

Figure 7.16 is an example of how the screen might appear, with the selected functions shown in bold. Users then select Continue from the attached menu.

ASQS

SYSTEM DECOMPOSITION FOR Generic System

Select nodes from the tree with the middle button.

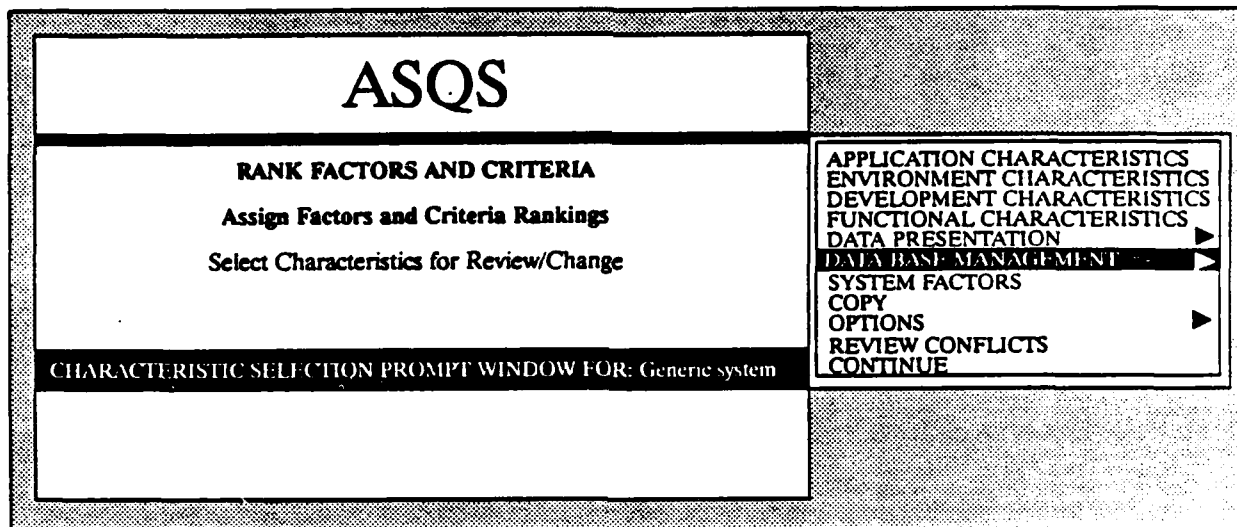
Generic System

- FUNCT. CAPAB (25%)**
- INFORMATION STORAGE (25%)**
- INTEGRATION FRAMEWORK (25%)**
- SYSTEM SOFTWARE (25%)**
- HARDWARE (0%)

SELECT FUNCTIONS  
DE-SELECT FUNCTIONS  
OPTIONS  
CONTINUE

Figure 7.16 Selected Functions in Bold

Now that functions have been chosen for review, specific characteristics of those functions must be selected for consideration. Figure 7.17 shows the window and attached menu for selecting characteristics.



**Figure 7.17 Selection of Characteristics**

The selection of characteristics provides the user with considerable flexibility. One, all, or any combination of the characteristics may be selected. Then select Continue from the attached menu. The subsequent review and consultation can, therefore, be tailored to be more narrowly focused or to range more broadly, depending on the user need.

When a characteristic is selected, it will be lightly shaded as shown in Figure 7.17.

Briefly described, the selections from the attached menu are:

**Application Characteristics:** are those characteristics having to do with the nature of the application. For example, "Does failure to produce a correct result affect human lives?"

**Environment Characteristics:** are the characteristics of the environment in which it must ultimately function. For example, "Is this an embedded system?"

**Development Characteristics:** are those issues concerned with how the system will be developed. For example, "What computer language will be used?"

**Functional Characteristics:** are those characteristics describing what the system must do. For example, "Does this system need to perform data-base management?"

**Data Presentation:** (with a sub-menu of Select Data Presentation Parameters and Select Data Presentation Capabilities) are those charac-

teristics having to do with formatting and transforming data, as necessary, for convenient and understandable display to humans.

**Database Management:** (with a sub-menu of **Select Database Management Parameters** and **Select Database Management Capabilities**) are those characteristics having to do with the management, storage, and access to large amounts of data.

**System Factors:** are those quality factors having to do with system level issues such as **Availability, Safety, Transportability**.

**Survey Results:** (with a sub-menu of **Select Survey Parameters** and **Select Surveys**) that information obtained from surveys of those knowledgeable in systems of this type.

**Options** provides the standard **Options** Sub-menu of **Roadmap, Glossary, Help, Previous Step**.

Now that the characteristics for review have been selected, select Continue and the Answer Window will be displayed (see Figure 7.18.)

ASQS		
ANSWERS FOR Generic System		CHANGE ANSWER DELETE ANSWER READ NOTE EXPLAIN CHANGE EXPLANATION OPTIONS
SOFTWARE-FUNCTION-NAME	INFORMATION STORAGE INTEGRATION FRAMEWORK	
REQUIRED-TO-IDENTIFY-AND-REPORT-ACC	NO	SONS
REQUIRED-TO-LIMIT-USER-ACCESS-BY-IDE		SONS
SOFTWARE-FUNCTION	data base management	SONS
SURVEYEE-NAME		SONS
SURVEYEE-ORGANIZATION	Using-Command	Using-Command
SURVEYEE-PROJECT-TITLE	AMH	AMH
NAME-OF-SURVEYEE		
SURVEYEE-RESPONSIBILITY		
CONSULT-STEM-FACTORS	YES	YES
SYSTEM-RELIABILITY-IS-NEEDED	MEDIUM	MEDIUM
SYSTEM-SAFETY-IS-NEEDED		UNKNOWN
SYSTEM-AVAILABILITY-IS-NEEDED		
LOW-FREQUENCY-OF-SOFTWARE-ERROR	HIGH	HIGH
CRITICAL-FAILURES-REQUIRE-SOFTWARE	YES	YES
SOFTWARE-ERRORS-MUST-BE-LOCATED	YES	YES
LOW-FREQUENCY-OF-SOFTWARE-ERROR	YES	YES
CONFORMANCE-TO-SOFTWARE-SPECIFIC	YES	YES
UNAUTHORIZED-ACCESS-ADVERSELY-AFX	YES	YES
ANALYSIS-REQUIRED-TO-CHECK-RESULTS		YES
ADEQUATE-VISIBILITY-INTO-CORRECTNES		NO
FAILURE-TO-PRODUCE-RESULT-AFFECTS		YES
FAILURE-TO-PRODUCE-RESULT-AFFECTS		YES
INCORRECT-RESULT-AFFECTS-HUMAN-LIV		YES
INCORRECT-RESULT-AFFECTS-EQUIPMEN		YES
EMBEDDED-SYSTEM		NO
SELF-PROTECT-MODE		NO
DIFF-BTWN-DEVELOPMENT-TESTING-ENV		
		Input Output Subsystem

Figure 7.18 Answer Window

The lower left portion of the window shows the specific characteristics that were selected for review. The lower right portion of the window shows answers for those functions for the specific characteristics that were selected. These answers may be selected and changed or deleted. First select Change Answer from the attached menu, then select the specific answer that is to be changed. The prompt window will display the question, and the user may type in the new answer.

The attached menu also offers the user the capability to Delete Answer, read explanations and change them, and to Read Notes.

A standard Options sub-menu is also offered.



Note that some of the answers in the Answer Window read “SONS.” This indicates that there are several answers for that characteristic, for a variety of sub-functions. For example, in Figure 7.19 there are four “sons” displayed in a pop-up answer menu. Selecting from this pop-up menu is the same as selecting from any other menu in the ASQS System. If users wish to select some of these sons, simply return to the “Selection of Characteristics Window” (Figure 7.19), and select from the sub-menu for Database Management, Data Presentation, and Survey Results. These are the characteristics which can have “sons” or multiple answers.

[illegible]

7-23

Once a specific answer has been selected from the Answer Window to be changed, the question for that particular answer will be displayed in the prompt window as shown in Figure 7.20. The user can then enter the new answer. The user can also obtain a list of legal responses by typing a question mark followed by a carriage return (see Figure 7.20).

ASQS		
ANSWERS FOR Generic System		
Select an answer or parameter 20) Is PR-103FN3MS1DP2 required to identify and report access violations? .. ? Expected responses are: YES or NO Enter HELP for list of user options. ..		
<div> <div>CHANGE ANSWER DELETE ANSWER READ NOTE EXPLAIN CHANGE EXPLANATION OPTIONS</div> </div>		
SOFTWARE-FUNCTION-NAME	INFORMATION STORAGE INTEGRATION FRAMEWORK	
REQUIRED-TO-IDENTIFY-AND-REPORT-ACC	NO	SONS
REQUIRED-TO-LIMIT-USER-ACCESS-BY-IDE		SONS
SOFTWARE-FUNCTION	data base management	SONS
SURVEYEE-NAME		SONS
SURVEYEE-ORGANIZATION	Using-Command	Using-Command
SURVEYEE-PROJECT-TITLE	GOAT	GOAT
CONSULT-SYSTEM-FACTORS	YES	YES
SYSTEM-RELIABILITY-IS-NEEDED	MEDIUM	MEDIUM
SYSTEM-SAFETY-IS-NEEDED		UNKNOWN
SYSTEM-AVAILABILITY-IS-NEEDED	HIGH	HIGH
LOW-FREQUENCY-OF-SOFTWARE-ERROR	YES	YES
CRITICAL-FAILURES-REQUIRE-SOFTWARE	YES	YES
SOFTWARE-ERRORS-MUST-BE-LOCATED	YES	YES
LOW-FREQUENCY-OF-SOFTWARE-ERROR	YES	YES
CONFORMANCE-TO-SOFTWARE-SPECIFIC	YES	YES
UNAUTHORIZED-ACCESS-ADVERSELY-AFR	YES	YES
ANALYSIS-REQUIRED-TO-CHECK-RESULTS		YES
ADEQUATE-VISIBILITY-INTO-CORRECTNES		NO
FAILURE-TO-PRODUCE-RESULT-AFFECTS		YES
FAILURE-TO-PRODUCE-RESULT-AFFECTS		YES
INCORRECT-RESULT-AFFECTS-HUMAN-LIV		YES
INCORRECT-RESULT-AFFECTS-EQUIPMEN		YES
EMBEDDED-SYSTEM		NO
SELF-PROTECT-MODE		Input Output Subsystem
DIFF-STWN-DEVELOPMENT-TESTING-ENV	GOAT	GOAT
SURVEYEE-PROJECT-TITLE	Using-Command	Using-Command
SURVEYEE-ORGANIZATION		
NAME-OF-SURVEYEE		
SURVEYEE-RESPONSIBILITY		

Figure 7.20 Answer Window with User Prompts

It is important to note that rankings are not shown after a Review/Change Answer session. This session addresses only previously asked questions, and is of primary importance for review. However, when answers are changed, ASQS may have several additional questions to pose to the user based on the new information. These new questions will be posed only in a consultation session. It is outside the scope of the Review session to pose these questions. Therefore, rankings are not shown, since they might be based on incomplete information. A user should now proceed to "Consult and Show Rankings" (see page 7-25). This allows ASQS to complete its questioning based on the reasoning and new information provided up to this point.

## Consult and Show Rankings

This selection from the Options menu runs a consultation at the end of which the current rankings are displayed. This selection opens several ASQS windows concurrently as shown in Figure 7.21.

FACTOR GAUGES PANEL												
EFFICIENCY	INTEGRITY	RELIABILITY	SURVIVABILITY	USABILITY	CORRECTNESS	MAINTAINABILITY	VERIFIABILITY	EXPANDABILITY	FLEXIBILITY	INTEROPERABILITY	PORTABILITY	REFLEXIBILITY
1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -
0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -
0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -
0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -
0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -
0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -
0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -
0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -
0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -
0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -
0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -

ASQS question window

Are there any surveys for sample 1 ?

Select:
YES  
NO  
UNKNOWN

WHY
HOW
G-HOW
HELP
STOP
CF
COMMENT
CHANGE

ASQS Why window -- SAMPLE1

ASQS Consultation log window -- SAMPLE1

1) What is the mission area of PR-103 Software Tools  
 2) What is the software type of PR-103 Software development environments  
 3) What is the name of project PR-103 ? SAMPLE1

ASQS Conclusion Window

Figure 7.21 Consultation Window Group

The Question window shown in Figure 7.22 allows the user to ask WHY and HOW by simply selecting the word. The user will receive an explanation of WHY a question was asked, or HOW a conclusion was arrived at. This explanation is logged in the Why Window as shown in Figure 7.25. (For more information on this window see p. 5-15.) Users also have the capability of selecting G-HOW, short for Graphic HOW, which shows the entire reasoning chain leading to certain conclusions.

ASQS question window								Select: - - -
Are there any surveys for sample 1?								YES
								NO
								UNKNOWN
WHY	HOW	G-HOW	HELP	STOP	CF	COMMENT	CHANGE	

**Figure 7.22 Consultation Question Window**

## Factor Gauges Panel Window

This window (shown in Figure 7.23), which cannot be re-sized or closed, is automatically shown by ASQS when you select Consult and Show Rankings from the Ranker menu. As you go through a consultation, the Panel shows the amount of evidence, in scores ranging from 0 to 1, indicating that you need a certain factor for a function. The Panel represents Accumulated Evidence for the function you have already selected for your consultation. ASQS goes through a consultation for each function you select, one at a time. The scores here are 0.0 on everything, as no consultation has yet been run. A similar Factor Gauges Panel appears when you select Revise Rankings Based on Factor Interrelationships (see p. 7-41), showing evidence for positive and negative factor interrelationships.

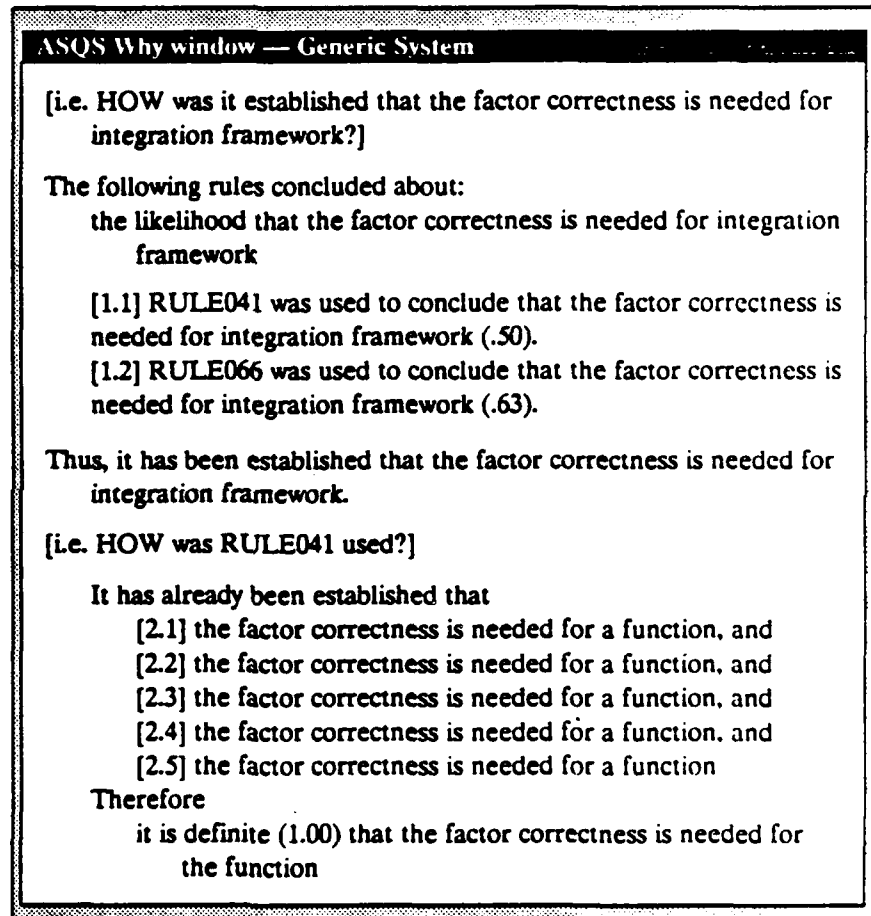
FACTOR GAUGES PANEL												
EFFICIENCY	INTEGRITY	RELIABILITY	SURVIVABILITY	USABILITY	CORRECTNESS	MAINTAINABILITY	VERIFIABILITY	EXPANDABILITY	FLEXIBILITY	INTEROPERABILITY	PORTABILITY	REFUSABILITY
1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -
0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -
0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -
0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -
0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -
0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -
0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -
0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -
0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -
0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -
0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -

Figure 7.23 The Factor Gauges Panel Window Before a Consultation

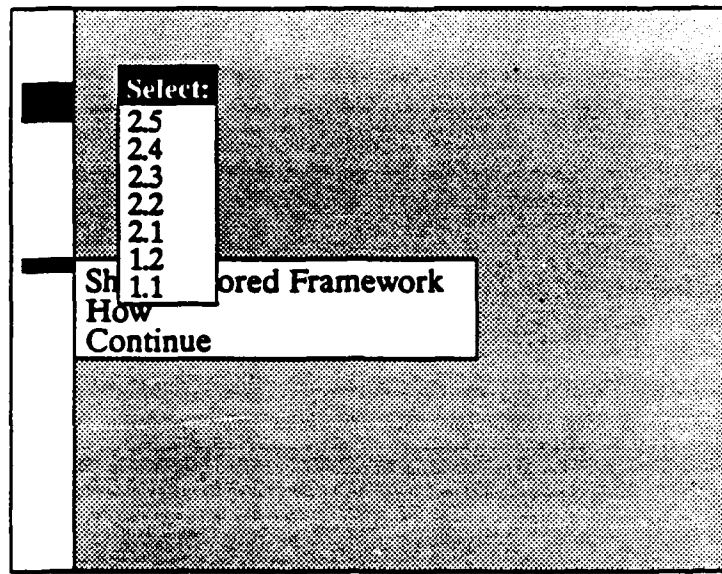
ACCUMULATED EVIDENCE FOR: COMMUNICATION												
EFFICIENCY	INTEGRITY	RELIABILITY	SURVIVABILITY	USABILITY	CORRECTNESS	MAINTAINABILITY	VERIFIABILITY	EXPANDABILITY	FLEXIBILITY	INTEROPERABILITY	PORTABILITY	REFUSABILITY
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -	1.00 -
0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -	0.90 -
0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -	0.80 -
0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -	0.70 -
0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -	0.60 -
0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -	0.50 -
0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -	0.40 -
0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -	0.30 -
0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -	0.20 -
0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -	0.10 -
0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -	0.00 -

Figure 7.24 The Factor Gauges Panel Window Showing Accumulated Evidence Scores for the Selected Function

Figure 7.25 shows the Why Window with each rule, inference and answer used to reach the conclusion, numbered. It is important to note that in Figure 7.25, the items numbered 2.1 through 2.5, which contributed to establishing a need for correctness, were previously concluded from answers or another rule. The user can follow the trail of reasoning, using HOW, back to that user supplied answer or survey information (see Figure 7.26 and accompanying text).



**Figure 7.25 Why Window**



**Figure 7.26 Pop-up Menu for HOW**

The user can ask HOW certain rules were used by selecting HOW from the attached menu again. Figure 7.26 shows the pop-up menu that will appear providing the user with the numbered choices for specifying which rule, or inference, needs further explanation. These numbers correspond to those in the Why Window. It is very important that the user become comfortable with following a trail of reasoning using WHY and HOW.

Selection of Graphic HOW (G-HOW) allows the user to develop the same line of reasoning in a graphic format instead of textual (see Figure 7.26a). When you select G-HOW, the ASQS prompts you for the parameter. Type in one of the parameters from the Conclusion Window, for example RELIABILITY-IS-NEEDED-MS and press Return. The Graphic HOW window automatically appears. As the prompt indicates, you scroll through the Graphic HOW window (using the left and right buttons) through the graphically-portrayed reasoning chain for the selected parameter(s). When you select an item with the middle button, ASQS generates one of two pop-up menus, depending on the type of information you have selected.

## ASQS

REASONING CHAIN FOR: RELIABILITY-IS-NEEDED-MS OF (genprop)

Select appropriate portion of the graph by scrolling or using the left button to center a specific item.

Make selections by using the middle button.

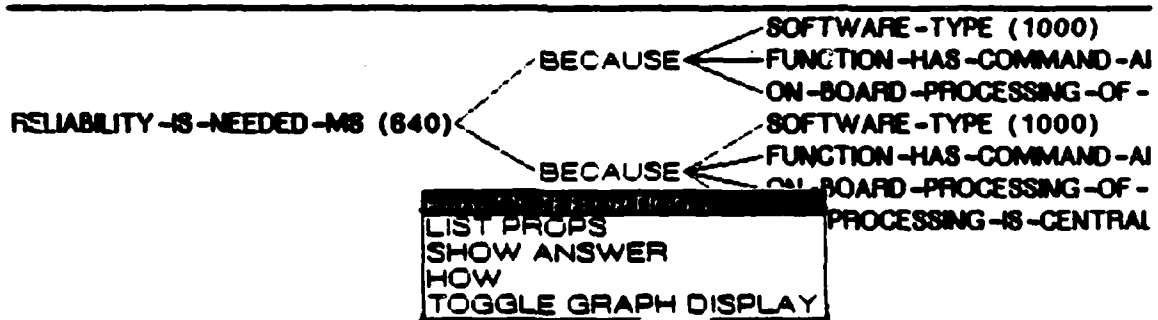


Figure 7.27 Selection of Graphic HOW Gives the Entire Reasoning Chain

The graphic explanation system may additionally display 1) rules that could have had an impact on the conclusions, but did not, and 2) any parameters that were traced but for which the desired conclusion failed (displayed in lighter type), as shown in Figure 7.28. To control the graph display use the TOGGLE GRAPH DISPLAY OPTION, shown on both Figures 7.27 and 7.28. This choice changes the explanation graph display between showing only rules and parameters that impacted the conclusions and showing all rules and parameters which did impact and could have impacted the conclusions.



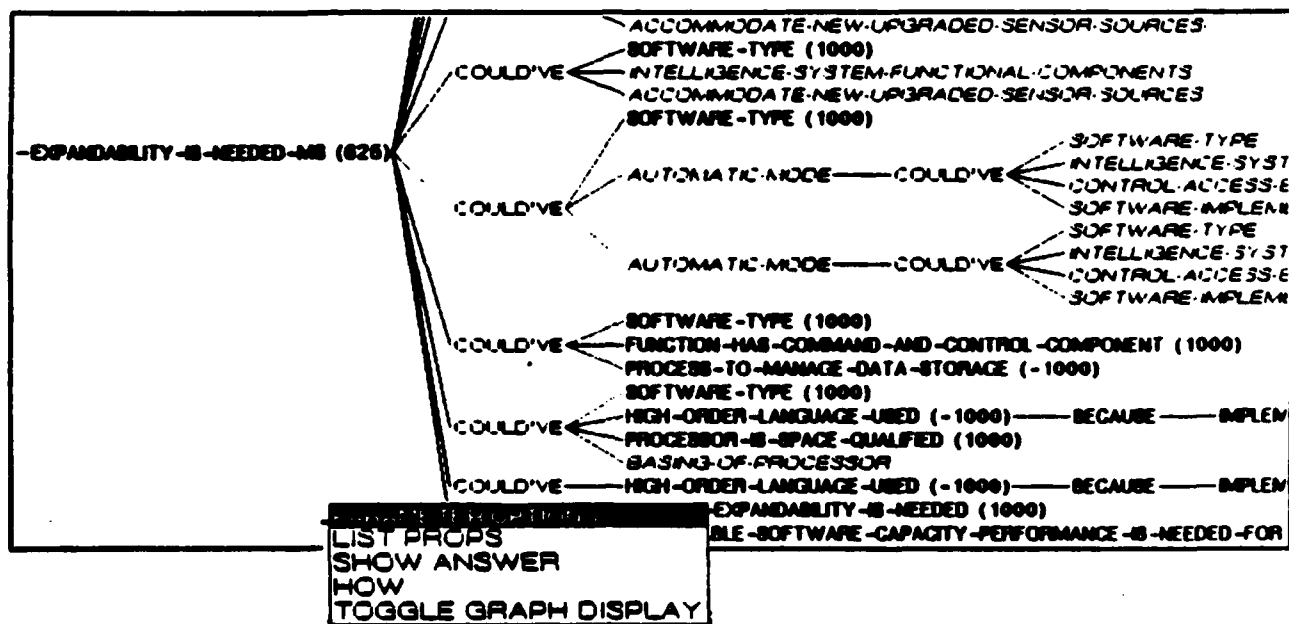


Figure 7.28 The Reasoning Chain with Display of Additional Ares of Reasoning

When you select a parameter, for example SOFTWARE-TYPE (1000), ASQS gives you a menu of Parameter options.

**List Properties** – lists the properties of the parameter, including all the rules that use the parameter.

**Show Answer** – shows the current answer for that parameter.

**How** – Shows you what the WHY window states for the selected parameter.

If you select a rule, by selecting the word because from the reasoning chain, ASQS shows you a menu of Rule Options.

**TRANS** – gives you an English translation of the rule.

**PPT** – gives you an abbreviated translation of the rule.

**PP** – the actual Lisp implementation of the rule.

**HOW** – gives you the reasoning chain for the rule's use.

When you wish to go on with the consultation, just return to answering ASQS-generated consultation questions. The G-HOW window disappears.

The Question window also allows COMMENTS to be entered. The user need only select the word COMMENT and they will be prompted as in Figure 7.29. It is important for users to enter comments as aids to understanding and as explanatory information for future reference.

ASQS question window

**What is the title of the surveyee in the context of this project ?**

Answer:

WHY	HOW	G-HOW	HELP	STOP	CF	COMMENT	CHANGE
-----	-----	-------	------	------	----	---------	--------

Comment: ^

**Figure 7.29 Question Window with Comment Prompt**

The Question window also allows Certainty (or Confidence) Factors (CF) to be entered before answers are entered. Confidence factors range from (-1) to (+1). A CF of -1 indicates absolute certainty that an answer is incorrect. A CF of 1 indicates absolute certainty that an answer is correct. A CF of greater than (-.2) but less than (+.2) is of insufficient strength for ASQS to draw conclusions based on it. Figure 7.30 shows the screen once the user has selected CF from the Question Window. The CF has a scroll bar function allowing you to use the mouse to set the CF value. You access the scroll bar by putting the cursor into the CF window, pressing the left mouse button, and dragging the mouse up and down to move the value bar up and down correspondingly. Use the middle button to select a specific point in scale for setting the CF value.

ASQS will utilize Confidence Factors in its calculations and conclusions if they are less than (-.2) or greater than (+.2).

ASQS will also utilize Certainty Factors to indicate the certainty of conclusions. The certainty of a conclusion is a function of the CF of the least certain premise and the CF of the rule used to draw the inference.

CF WINDOW	ASQS question window	Select:								
Certainty Factor .75 1.00 - 0.90 - 0.80 - 0.70 - 0.60 - 0.50 - 0.40 - 0.30 - 0.20 - 0.10 - 0.00 - -0.10 - -0.20 - -0.30 - -0.40 - -0.50 - -0.60 - -0.70 - -0.80 - -0.90 - -1.00 -	Will the genproj have sufficient spare memory storage capacity to accommodate continued mission performance in the case of a primary memory storage failure?  <table border="1"> <tr> <td>WHY</td> <td>HOW</td> <td>G-HOW</td> <td>HELP</td> <td>STOP</td> <td>CF</td> <td>COMMENT</td> <td>CHANGE</td> </tr> </table>	WHY	HOW	G-HOW	HELP	STOP	CF	COMMENT	CHANGE	YES NO UNKNOWN
WHY	HOW	G-HOW	HELP	STOP	CF	COMMENT	CHANGE			

Figure 7.30 Question Window with CF Prompt

The Consultation Log Window logs the Confidence Factor and the comment along with the question. Thus, it becomes a permanent part of the consultation record. (See Figure 7.31.)

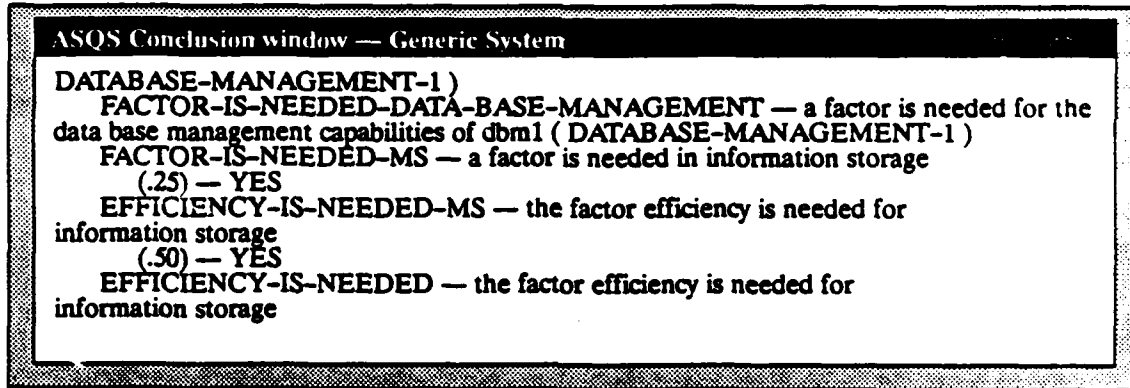
ASQS Consultation log window — Generic System
MEDIUM 35) Is the satisfaction of system reliability requirements for information storage adversely affected by accidental or deliberate unauthorized access to the software or data ? YES 36) Does the frequency of software errors need to be low in order to satisfy the system safety requirements for information storage ? YES 37) Please select those aspects of the development environment of information storage that are different from the testing environment, if any. Word Size ( 3 ) (COMMENT THIS DEVELOPMENT ENVIRONMENT MAY CHANGE WITH THE ACQUISITION OF NEW HARDWARE.)

Figure 7.31 Log Window with Comments

The Question Window (Figure 7.22) also allows the user to request HELP, CHANGE an answer, or STOP the consultation session whenever they would like. If they wish to Change an answer the Question window will prompt for the number of the question that requires a new answer. This number can be obtained by looking in the Consultation Log Window and scrolling if necessary. Users can also enter a list of question numbers, for which they would like to change the answers.

### The Conclusion Window

Figure 7.32 shows a Conclusion Window. All non-trivial conclusions and inferences regarding the quality specification will be logged here. Note also that ASQS displays a confidence level in the conclusion.



**Figure 7.32 The Conclusion Window**

## During the Consultation Session

During a session, as you answer questions about the software functions, ASQS generates scores on the Factor Gauges Panel, so this window will be constantly changing in response to your answers. The new Consultation Window Group looks like that in Figure 7.33.

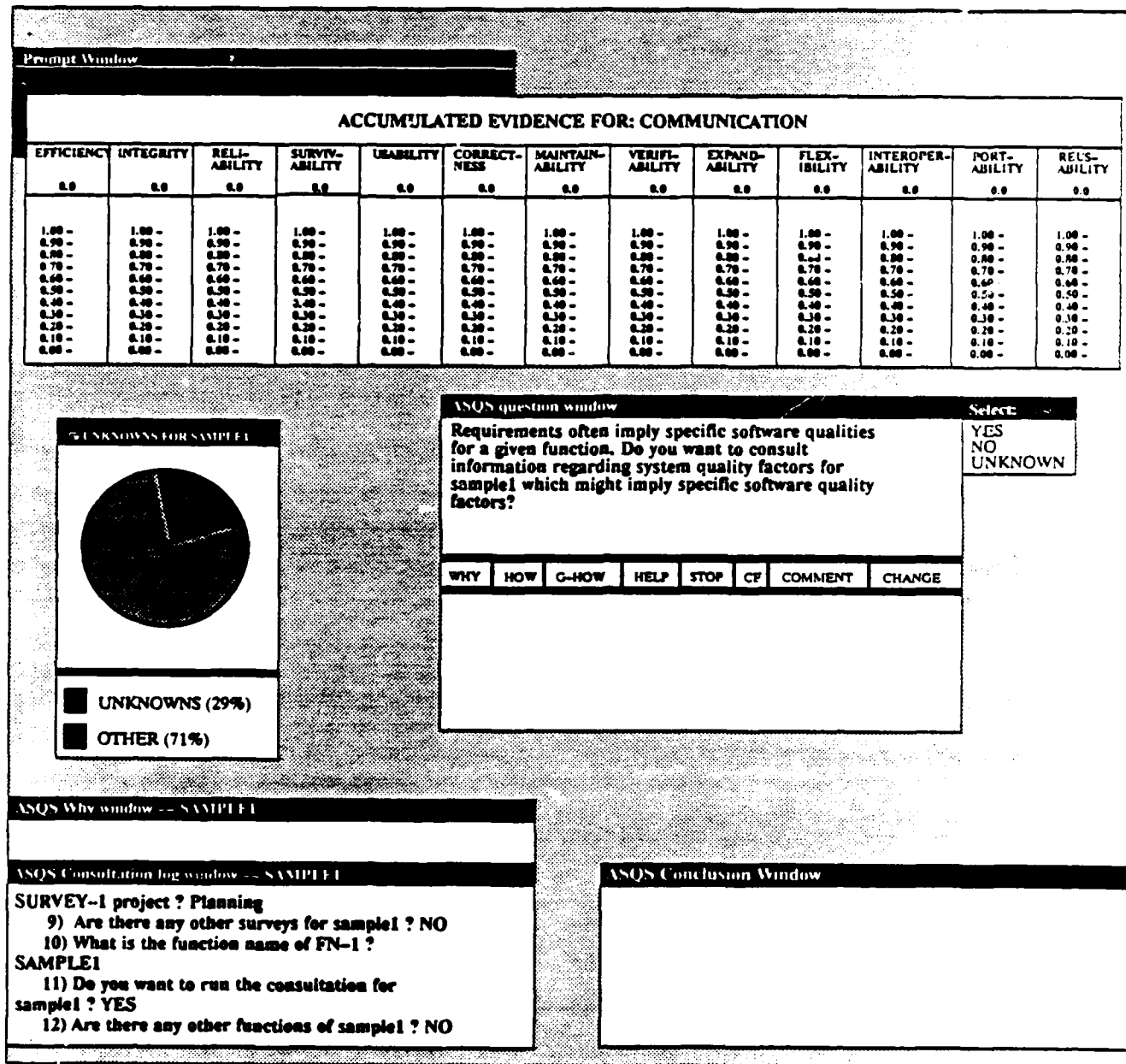
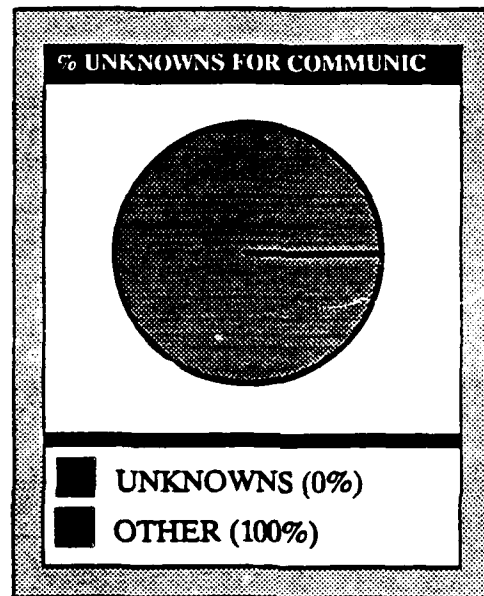


Figure 7.33 The Consultation Window Group During a Consultation

During the consultation, a graphic pie chart appears for each function, showing the percentage of unknowns for the project. An Unknown is when you select Unknown from the menu in response to a question. This pie chart (see Figure 7.34) also changes, showing the current percentage rate during the consultation. The percentage of Unknowns gives you an idea of how much more information you may need to determine about the system during later consultations and which may affect your decisions about the confidence of your current rankings. You can shrink, re-size, or SNAP the pie chart window for hard copy printing.



**Figure 7.34 The Pie Chart for Unknowns Window**

#### **Ending the Consultation Session**

When you have finished a consultation, select **Done**, which brings up the Factor Ranking window. You can see the reasoning chain for the assignment of rankings by selecting a ranking with the middle button. You will get a graphic tree window with the same functionality as the G-HOW window (see p. 7-27). Select **Continue** to close all the consultation windows and access the Disposition of Changes window. Selecting **Stop** during a consultation also ends a consultation.

ASQS may end the consultation when it has been given sufficient information to infer quality factor rankings. After giving rankings (see Figure 7.35), ASQS will request that the user determine the disposition of the changes that have been made, if any. (See Figure 7.36, the Disposition of Changes.)

<h1>ASQS</h1>													
FACTOR RANKINGS FOR Generic System													
<b>RANK FACTORS AND CRITERIA</b> Assign Factor and Criteria Rankings SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS												How Continue	
SOFTWARE QUALITY FACTOR   SYSTEM OR SOFTWARE UNIQUE FUNCTION	<b>PERFORMANCE</b>				<b>DESIGN</b>			<b>ADAPTATION</b>					
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
COMMUNICATION	M	H	H	H		H	M		M				L

**Figure 7.35 Factor Rankings Matrix**

<h1>ASQS</h1>	
<b>RANK FACTORS AND CRITERIA</b> Identify Application/Functions Determine Disposition of Changes	<b>REFINING/ENHANCING EXPLORING POSSIBILITIES DISCARD CHANGES OPTIONS</b>
ASQS VERSION DISPOSITION PROMPT WINDOW FOR: Generic System	
Determine the disposition of pending changes by indicating whether you are refining or enhancing the specification (REFINING/ENHANCING) or exploring alternative possibilities for the next level of refinement (EXPLORING POSSIBILITIES). DISCARD CHANGES will delete the pending changes.	

**Figure 7.36 Disposition of Changes**

Refining/Enhancing creates a new current version. This will then appear in the Version Management Window, displayed in bold with the highest version number. In Figure 7.37, versions 82 and 83 were created with this option. Remember, you will have to type responses to the system requests for 1) why you are refining and enhancing the specification, and 2) what changes you have made since the last consultation. This is important, as the information you give at this point is stored for access when you request Version Management information.

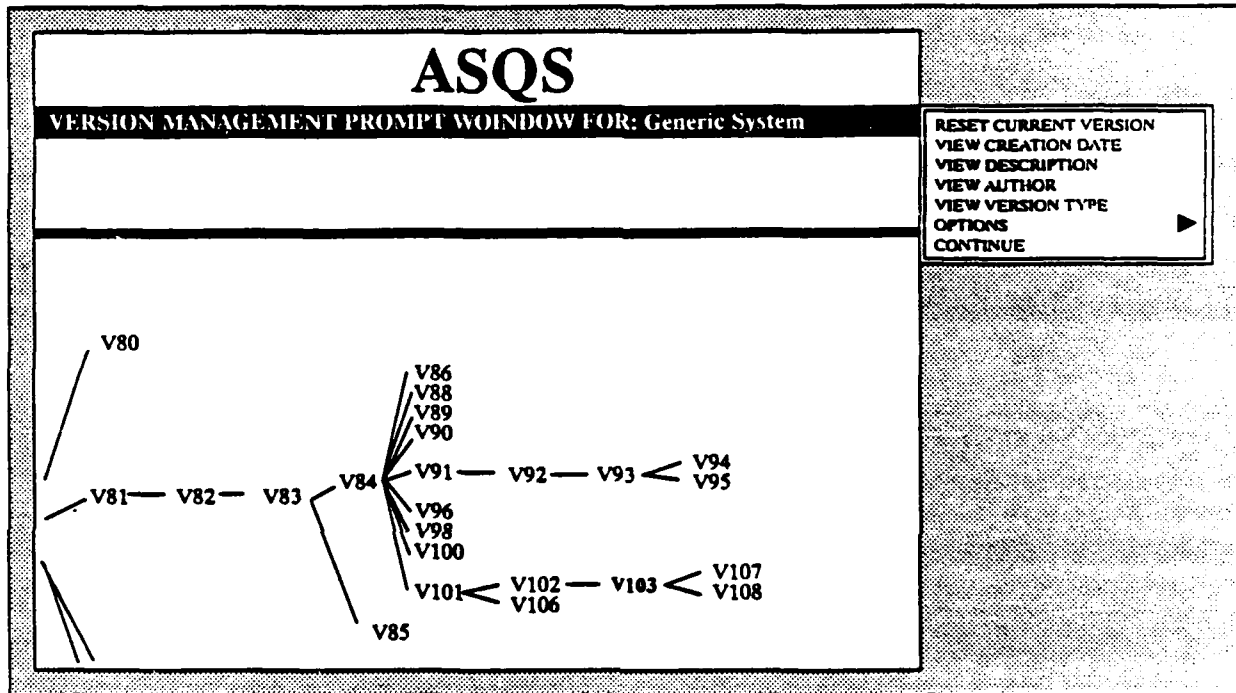


Figure 7.37 Version Management Window

**Exploring Possibilities** creates a version but does not make it the current version. It allows the user to enter an explanation for creating this possibility, and a description of the changes that were made during this exploration. Figure 7.37 of the Version Management window shows version 103 in bold as the current version. Versions 107 and 108 were created and saved when the user selected "Exploring Possibilities." When you select this option, ASQS queries you about why you are exploring possibilities, and then asks for a description of the changes made since the last Disposition of Changes.

**Discard Changes** does not save a new version, only resets the last version before any changes were made as the current working version, and returns to the Ranker Options menu.



## Revise Rankings Based on Interrelationships

Here the system allows the user the same Ranker Options menu as "Assign Factors and Criteria Rankings"; however, the consultation will run through until questions concerning factor interrelationships are encountered. Then it will stop and ask these questions to clarify the interrelationship issues. This option also uses the same graphic features de-

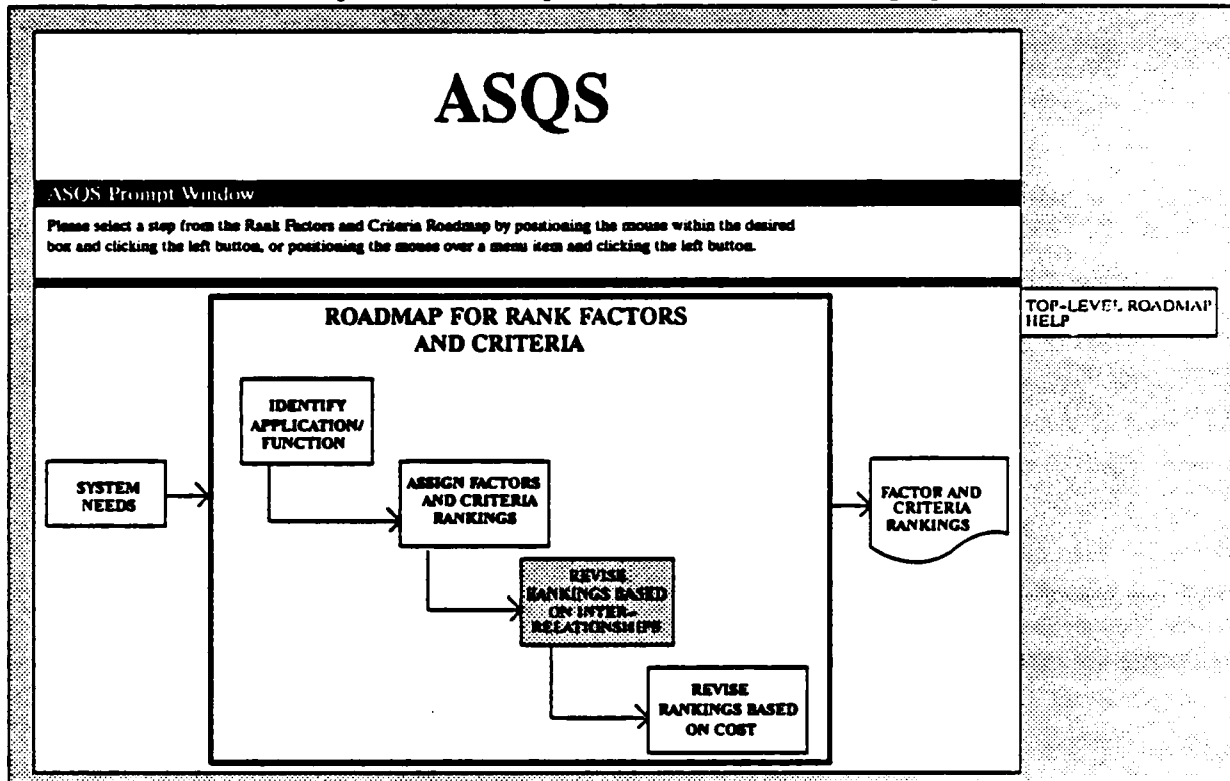


Figure 7.38 Selecting "Revise Rankings Based on Interrelationships"

scribed in the discussion on "Assign Factors and Criteria Rankings". The pie chart demonstrates the percentage of Unknowns (as provided as answers to Factor Interrelationship questions during consultation). The Factor Gauge Panel, in this case, provides evidence, in scores ranging from -1 to 1, for the need of factors as a reflection of interrelationships between the factors. At the end of this consultation, ASQS provides another value matrix of the revised rankings. Users may once again select Why and How for graphic or tabular explanations of the revised rankings.

Select from the Ranker Roadmap as shown in Figure 7.38.

When the consultation is completed, the Factor Identification Form shows the revised rankings, (see Figure 7.39).

Note the "H+2" for Information Storage, and the "H+3" for Functional Capability under the quality factor Correctness. The numbers

ASQS													
FACTOR RANKINGS FOR Genetic System													
RANK FACTORS AND CRITERIA												How Continue	
Assign Factor and Criteria Rankings													
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS													
SOFTWARE QUALITY FACTOR	PERFORMANCE					DESIGN			ADAPTATION				
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
SYSTEM OR SOFTWARE UNIQUE FUNCTION													
INFORMATION STORAGE		H	H	H		M+2	M						
FUNCT CAPAB		M	H			H+2	M	L					

Figure 7.39 Revised Rankings

appearing with the rankings on this form may range from (-9) to (+9). They represent a confidence level in the evidence that the existing inter-relationships will assist (+), or deter (-) the attainment of the quality goals. Indeed, some of these goals may have been raised from the initial quality goals obtained in the "Assign Factors" function. However, rankings on this form will not be lower than the initial rankings.

It is important for the user here to make use of HOW and Graphic HOW, in order to understand the reasons for strongly negative or strongly positive evidence. It may be that the quality goal expectations, or the functional expectations, need to be readjusted.

### Revise Rankings Based on Cost

ASQS allows the user the same Ranker Options menu as "Assign Factor and Criteria Rankings", however, the consultation will run through until questions concerning costs are encountered. Then it will ask the questions necessary to identify which software factor goals may be excessively costly to achieve, as a result of competitive factor relationships with other goals.

Select from the Ranker Roadmap as shown in Figure 7.40.

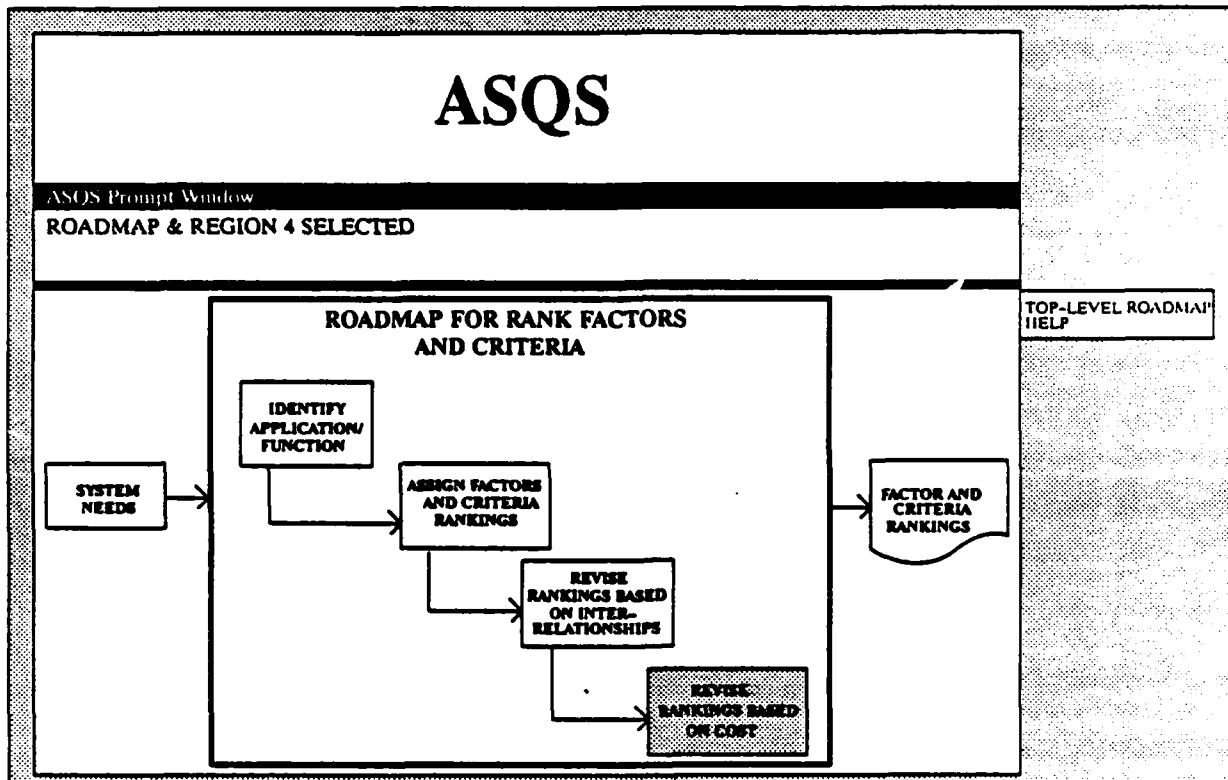


Figure 7.40 Selecting "Revise Rankings Based on Costs"

When the consultation is completed, the Factor Identification Form shows the updated rankings as shown in Figure 7.41.

ASQS														
FACTOR RANKINGS FOR Generic System														
RANK FACTORS AND CRITERIA														
Assign Factor and Criteria Rankings														
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS														
<div style="display: flex; justify-content: space-between;"> <div>SOFTWARE QUALITY FACTOR</div> <div>SYSTEM OR SOFTWARE UNIQUE FUNCTION</div> </div>		PERFORMANCE					DESIGN			ADAPTATION				
		EFFICIENCY	INTEGRITY	RELIABILITY	SURVIVABILITY	USABILITY	CORRECTNESS	MAINTAINABILITY	VERIFIABILITY	EXPANDABILITY	FLEXIBILITY	INTEROPERABILITY	PORTABILITY	REUSABILITY
Command and Control		H*9	H*6	H	H		H	M	M	M			M	L

How  
Continue

Figure 7.41 Updated Rankings

Note the “\*9” and “\*6” under the quality factors Efficiency and Integrity. The numbers appearing with “\*” on this form may range from 1 to 9. They serve to notify the user of a “cost constraint”, and represent a confidence level in the evidence that there are adverse relationships with other factor goals, relationships which may cause a factor goal to be excessively costly to achieve (or possibly even un-achievable).

It is important for the user here to make use of the HOW facility, in order to understand the reasons for the cost constraints. It may be that the quality goal expectations need to be readjusted, or simply that the cost of achieving the desired set of goals will be high and therefore require close monitoring.

## **Chapter 8**

### **Quantify Factors**

#### **Chapter Contents**

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## Qualify Metrics

This ASQS function identifies the specific quality criteria and metric elements most relevant to the system under consideration. During this step, further consultation is necessary regarding qualifying the most relevant quality metrics. A tailored quality framework emerges. Figure 8.1 shows “Qualify Metrics” selected from the Quantifier Roadmap.

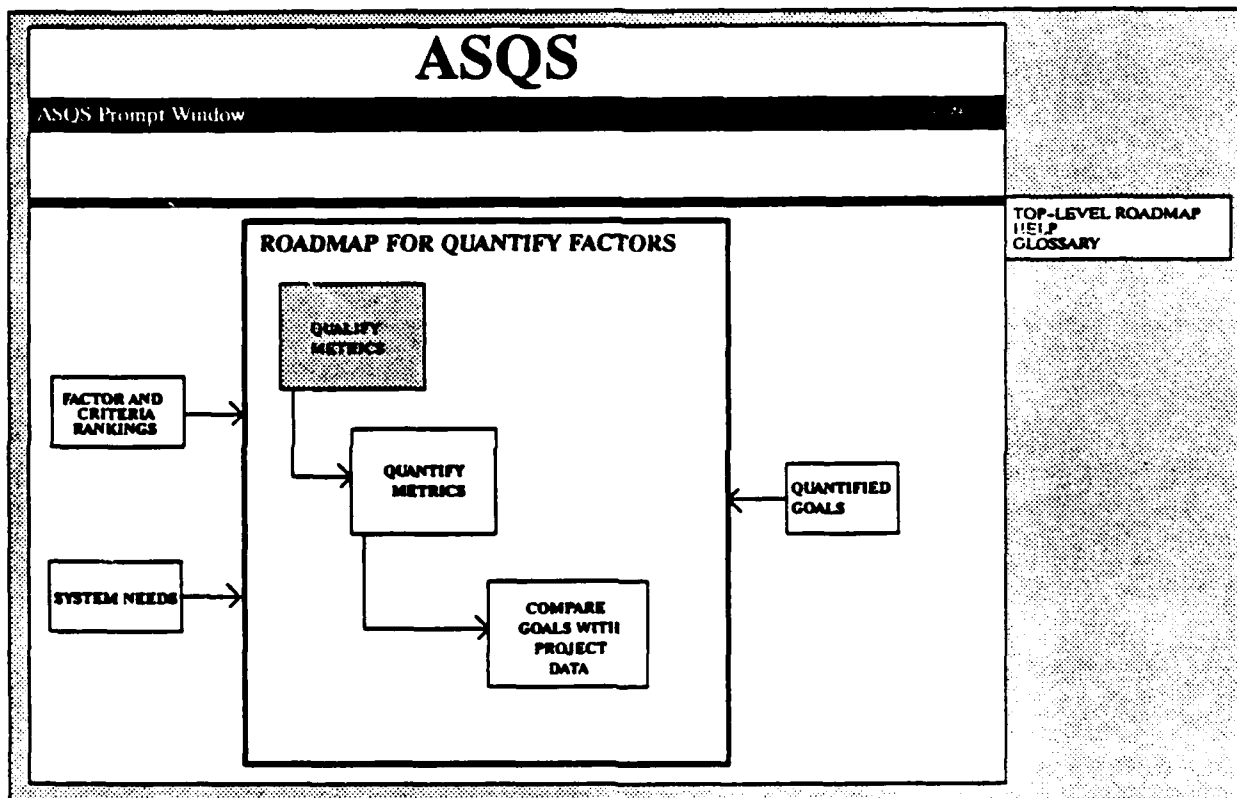
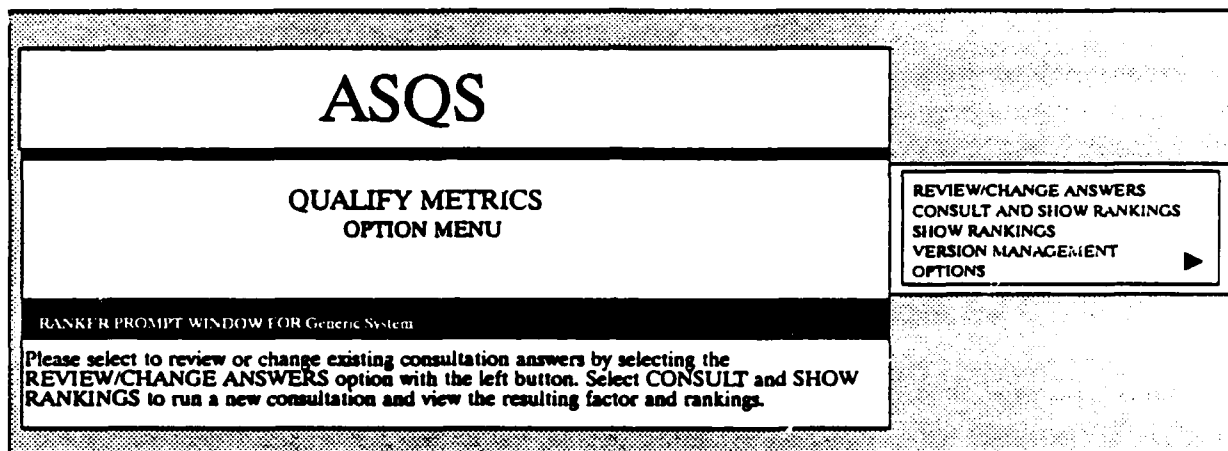


Figure 8.1 Selecting “Qualify Metrics”

Figure 8.2, the Qualify Metrics Option Menu, is the same as the Ranker Option Menu. The choices offered will function as described starting on page 7-14 in Chapter 7, The Ranker.

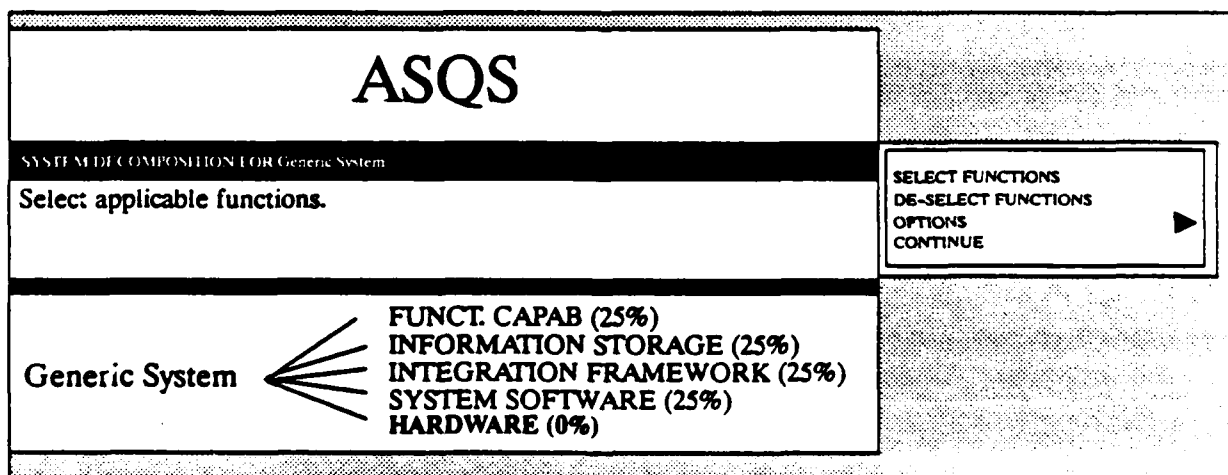
The focus of the consultation will be to pay particular attention to those questions and issues which will help identify specific quality criteria, and qualify the particular metric elements of those quality criteria. Select **Consult and Show Rankings**.



The screen displays the ASQS logo at the top. Below it, the title "QUALIFY METRICS OPTION MENU" is centered. A black bar with white text reads "RANKER PROMPT WINDOW FOR Generic System". Below this bar, a text box contains instructions: "Please select to review or change existing consultation answers by selecting the REVIEW/CHANGE ANSWERS option with the left button. Select CONSULT and SHOW RANKINGS to run a new consultation and view the resulting factor and rankings." On the right side, a menu box lists four options: "REVIEW/CHANGE ANSWERS", "CONSULT AND SHOW RANKINGS", "SHOW RANKINGS", and "VERSION MANAGEMENT", with a right-pointing arrow next to the last option.

**Figure 8.2 Qualify Metrics Option Menu**

As with other consultation sessions in the ASQS System, specific functions must be selected to be the topic of the consultation, as shown in Figure 8.3.



The screen displays the ASQS logo at the top. Below it, a black bar with white text reads "SYSTEM DECOMPOSITION FOR Generic System". Below this bar, the text "Select applicable functions." is displayed. On the right side, a menu box lists three options: "SELECT FUNCTIONS", "DE-SELECT FUNCTIONS", and "OPTIONS", with a right-pointing arrow next to the last option. Below the "Select applicable functions." text, the text "Generic System" is followed by a list of functions with their percentages: "FUNCT. CAPAB (25%)", "INFORMATION STORAGE (25%)", "INTEGRATION FRAMEWORK (25%)", "SYSTEM SOFTWARE (25%)", and "HARDWARE (0%)". A series of five lines radiate from the "Generic System" text to the list of functions.

**Figure 8.3 Select Functions for Consultation**

When the factor rankings are displayed as shown in Figure 8.4, the Qualifier begins to look different from functions in the Ranker. Note the attached menu.

ASQS													
Factor Rankings for Generic System													
RANK FACTORS AND CRITERIA													
Assign Factor and Criteria Rankings													
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS													
SOFTWARE QUALITY FACTOR	PERFORMANCE					DESIGN			ADAPTATION				
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
SYSTEM OR SOFTWARE UNIQUE FUNCTION													
COMMAND AND CONTROL	H	H	H	H		H	M	M	M			M	L

Show Tailored Framework  
 Generate Questions  
 How  
 Continue

Figure 8.4 Factor Identification Form

As in other ASQS functions it is important for the user to make use of HOW in order to understand the reasoning behind a quality factor ranking. First select the ranking of interest from the value matrix and an explanation of HOW that value was arrived at will appear in the Why Window with inferences and rules appropriately numbered (see p. 7-23). To follow the chain of reasoning back further, select HOW from the attached menu, and then select from the numbered pop-up menu, the number of the rule or inference for which further explanation is desired.



### Generate Questions

This option allows the user to select a phase, as shown in Figure 8.5, and then automatically generate (print) a worksheet of applicable metric questions for that selected phase.

### Show Tailored Framework

As stated above, the consultation in the Qualifier will pay particular attention to identifying quality criteria and qualifying specific metric elements. The results of this focus are shown to the user with a Tailored Quality Metrics Framework. First, select **Show Tailored Framework** from the menu attached to the Factor Identification Form (see Figure 8.4).

Figure 8.5 shows the next step, **Select Phase**.

ASQS	
QUANTIFY FACTORS	SYSTEM SOFTWARE REQUIREMENTS ANALYSIS SOFTWARE REQUIREMENTS ANALYSIS PRELIMINARY DESIGN DETAILED DESIGN CODING AND UNIT TESTING CSC INTEGRATION AND TESTING CSCI-LEVEL TESTING SYSTEM INTEGRATION AND TESTING OPTIONS ▶
TAILOR METRICS	
Select Phase	
Select Phase Window for: Generic System	
Please select a life-cycle phase for reviewing the tailored framework.	

Figure 8.5 Select Phase

Since a Quality Framework can vary both with function and with Software Life Cycle Phase, the user must indicate by selecting from the attached menu, what phase of the software life cycle is of current interest.

Figure 8.6 shows a Tailored Framework. This window is displayed immediately after the user has selected the Software Life-Cycle Phase. Those quality criteria and metric elements which have been qualified as relevant to this system are shown in bold. Those elements which have been "tailored out" as non-relevant are displayed in normal text.

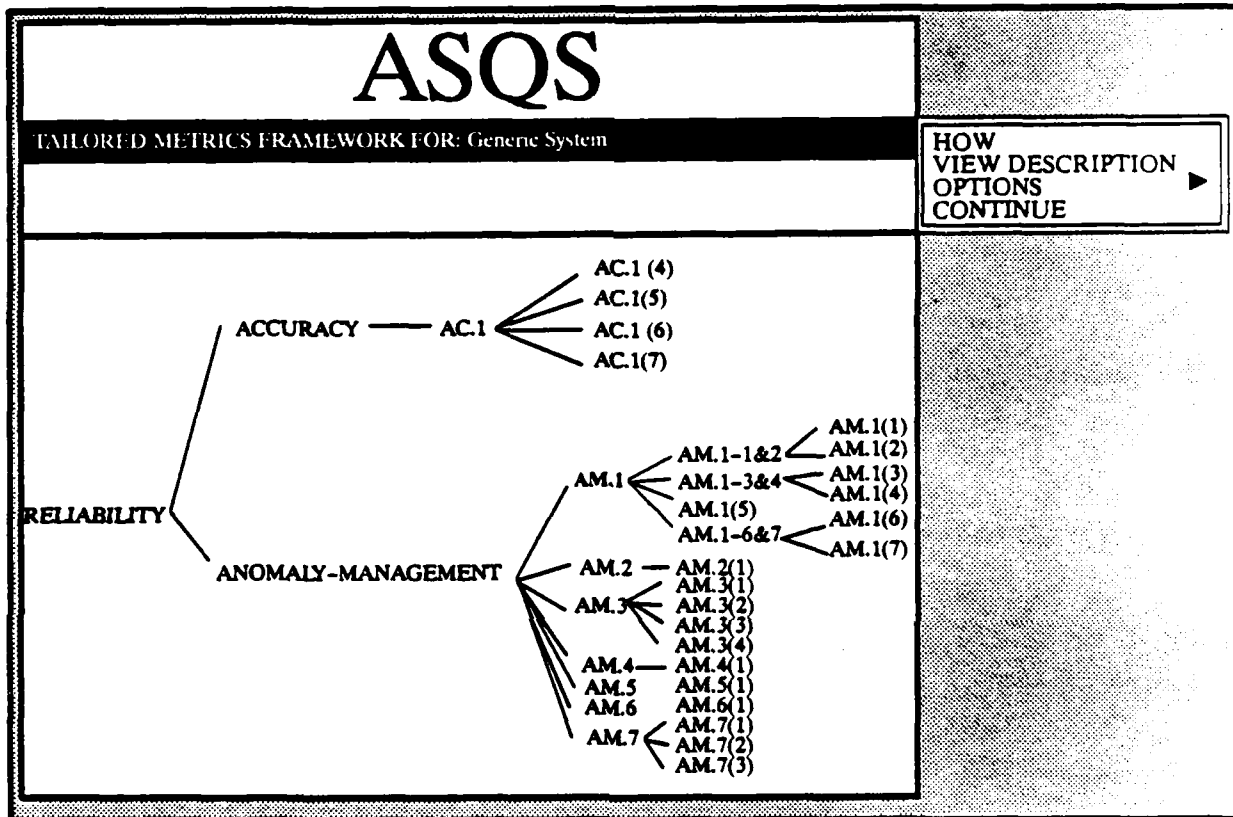


Figure 8.6 Tailored Framework

In this case, Reliability is needed for a function, and this was determined using the Ranker. The Qualifier assisted the user in focusing on Anomaly Management as the specific quality criteria contributing to Reliability which is most relevant for the system currently under consideration. Further, the Qualifier assisted in identifying Error Tolerance/Control (AM.1) as a particular metric element of Anomaly Management which will contribute to the Reliability of the system.

Users can obtain descriptions of these elements by selecting View Description from the attached menu and then selecting the quality factor or metric element from the framework.

Also, users can, and are encouraged to, obtain explanations of HOW the tailored framework was determined. Select HOW from the attached menu and then select a specific element from the framework.

## Quantify Metrics

Figure 8.7 shows Quantify Metrics selected from the Quantifier Roadmap.

Once Quantify Metrics has been selected from the Quantify Factors Roadmap, the Quantify Factors Option Menu will appear as shown in Figure 8.8. In order to quantify the metric elements in the tailored framework, users must run a consultation. Select Consult and Show Rankings.

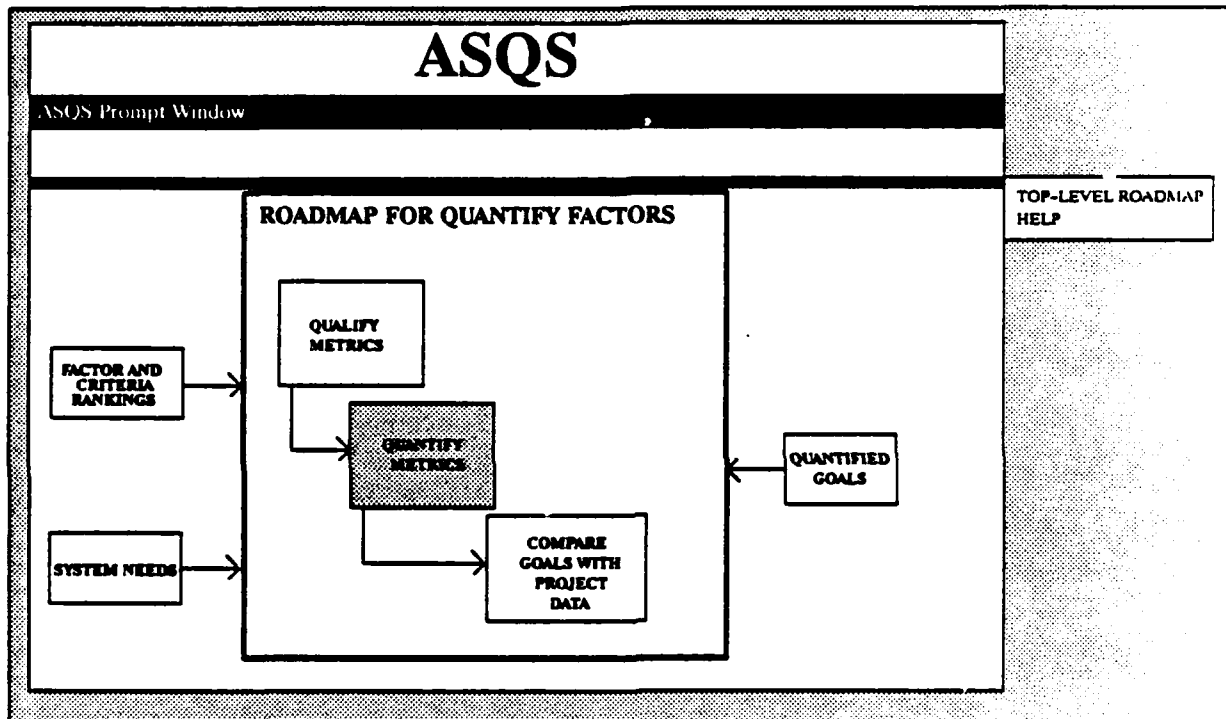


Figure 8.7 Selecting "Quantify Metrics"

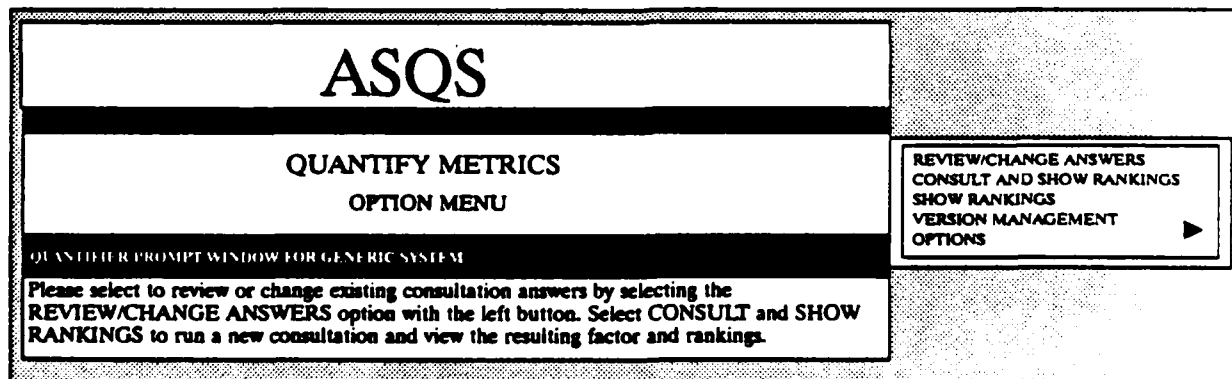
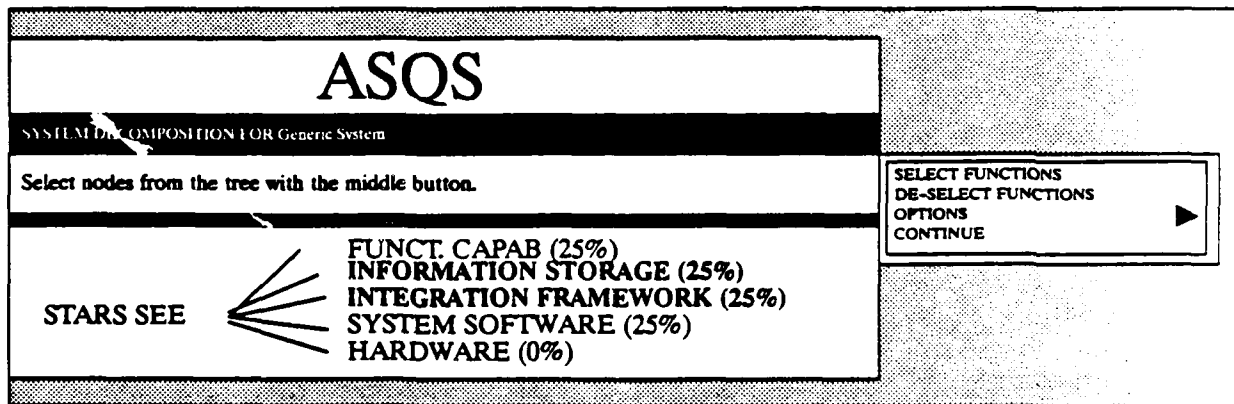


Figure 8.8 Quantify Factors Option Menu

As with other consultation sessions in the ASQS System, specific functions must be selected to be the topic of the consultation, as shown in Figure 8.9.

The purpose of quantifying the metric elements is to give the user some guidance on what a reasonable quality goal might be, in light of past experience with similar projects. ASQS will establish an expected range of values for each metric element, quality criteria and quality factor tailored into the framework in the previous function, "Qualify Metrics." The range of expected scores will comprise an upper bound and a lower bound. These are referred to as the baselines.



**Figure 8.9 Select Functions for Consultation**

ASQS has four sources for information to establish these upper and lower bounds. In the order of the priority that ASQS will give these sources, they are:

- 1) User-supplied baseline data for each metric element (see Figure 8.10).
- 2) Baselines inferred from the information acquired during consultations.
- 3) Baselines of previous projects in that mission area.
- 4) General baselines synthesized from projects not necessarily within that mission area.

ASQS question window

**what is the baseline lower bound of AM.1(1)a for information storage ?**

**Answer:**

WHY	HOW	G-HOW	HELP	STOP	CF	COMMENT	CHANGE
-----	-----	-------	------	------	----	---------	--------

**Figure 8.10 User-Supplied Lower Bound**

Figure 8.11 shows a Factor Identification Form with the expected range of scores for a quality factor. These scores are computed by averaging the scores of the lower level quality criteria and metric elements that make up this factor. The width of the value range is the mean score for the element, plus or minus one standard deviation.

ASQS													
Factor Ranking for Generic System													
RANK FACTORS AND CRITERIA													
Assign Factor and Criteria Rankings													
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS													
SOFTWARE QUALITY FACTOR	PERFORMANCE					DESIGN			ADAPTATION				
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
SYSTEM OR SOFTWARE UNIQUE FUNCTION													
INTEGRATION FRAMEWORK	-	-	1-8	-	-	-	-	-	-	-	-	-	-

Show Quantified Framework  
 How  
 Continue

Figure 8.11 Value Matrix of Expected Scores

The Certainty Factor (CF) for this range is the minimum CF of the criteria that make up this factor.

### Show Quantified Framework

The expected range of values in a Quantified Metric Framework varies depending upon the software life-cycle phase. Therefore, to see the quantified framework, a user must:

- 1) Select **Show Quantified Framework** from the attached menu in Figure 8.11.
- 2) Select the software phase currently under consideration from the **Select Phase** window displayed in Figure 8.12.

**ASQS**

**QUANTIFY FACTORS**  
Quantify Metrics  
Select Phase

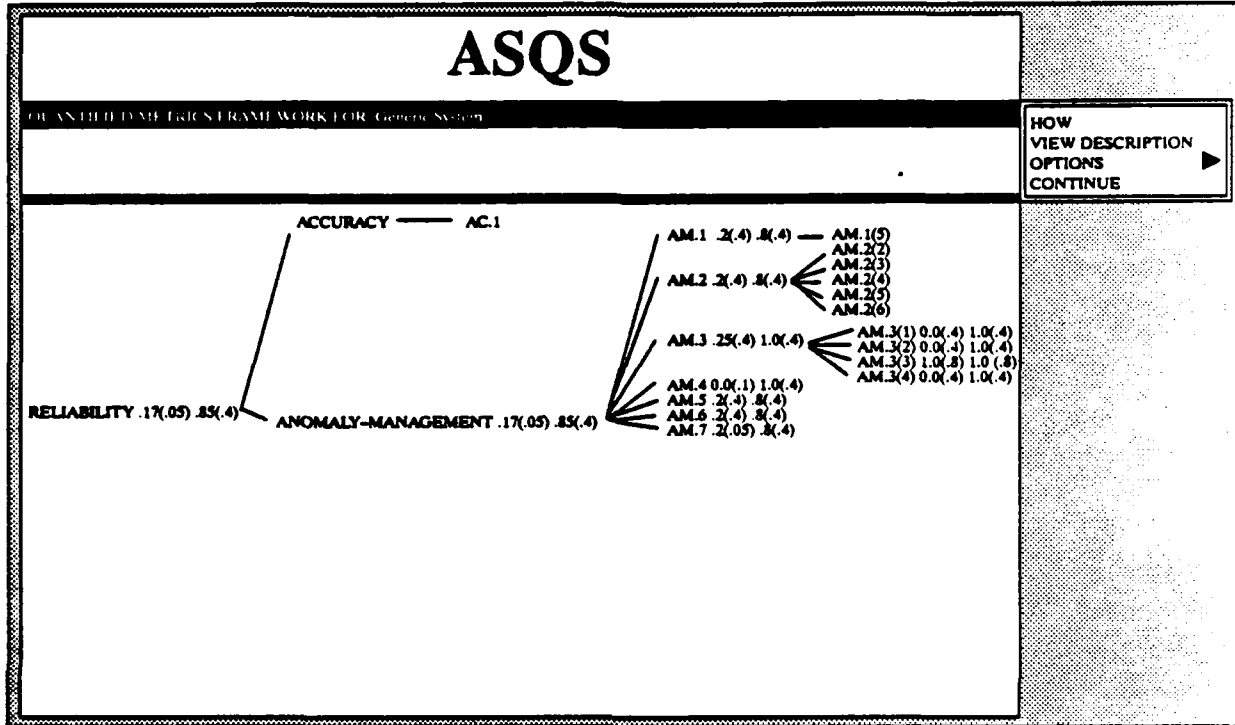
SYSTEM SOFTWARE REQUIREMENTS ANALYSIS  
SOFTWARE REQUIREMENTS ANALYSIS  
PRELIMINARY DESIGN  
DETAILED DESIGN  
CODING AND UNIT TESTING  
CSC INTEGRATION AND TESTING  
CSCI-LEVEL TESTING  
SYSTEM INTEGRATION AND TESTING  
OPTIONS

SELECT PHASE WINDOW FOR: Generic System

Please select a life-cycle phase for reviewing the quantified framework.

**Figure 8.12 Select Software Life-Cycle Phase**

Figure 8.13 shows a quantified framework. Note that each metric element, quality criteria and quality factor has both an upper bound value with a certainty factor, and a lower bound value with a certainty factor.



**Figure 8.13 The Quantified Framework**

In this figure Anomaly Management has a lower bound for the expected quality score of (.17), with a CF of (.05). It also has an upper bound for the expected quality score of (.85), with a CF of (.4).

**Chapter 9**  
**Assess Compliance**

**Chapter Contents**

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## Introduction

This ASQS function compares the ASQS-generated software quality goals with evaluated software quality scores as returned by the QQuality Evaluation System (QUES).

Before executing the Assessor, you must load the QUES files of system decomposition and metric scores for each selected function and life-cycle phase of the project under consideration. The QUES data should be located in the {dsk[lispfiles]eval} directory. To load the files, click on the Evaluation Data box on the ASQS Roadmap, as shown in Figure 9.1. To reach the Assessor, select Assess Compliance from the ASQS top-level roadmap.

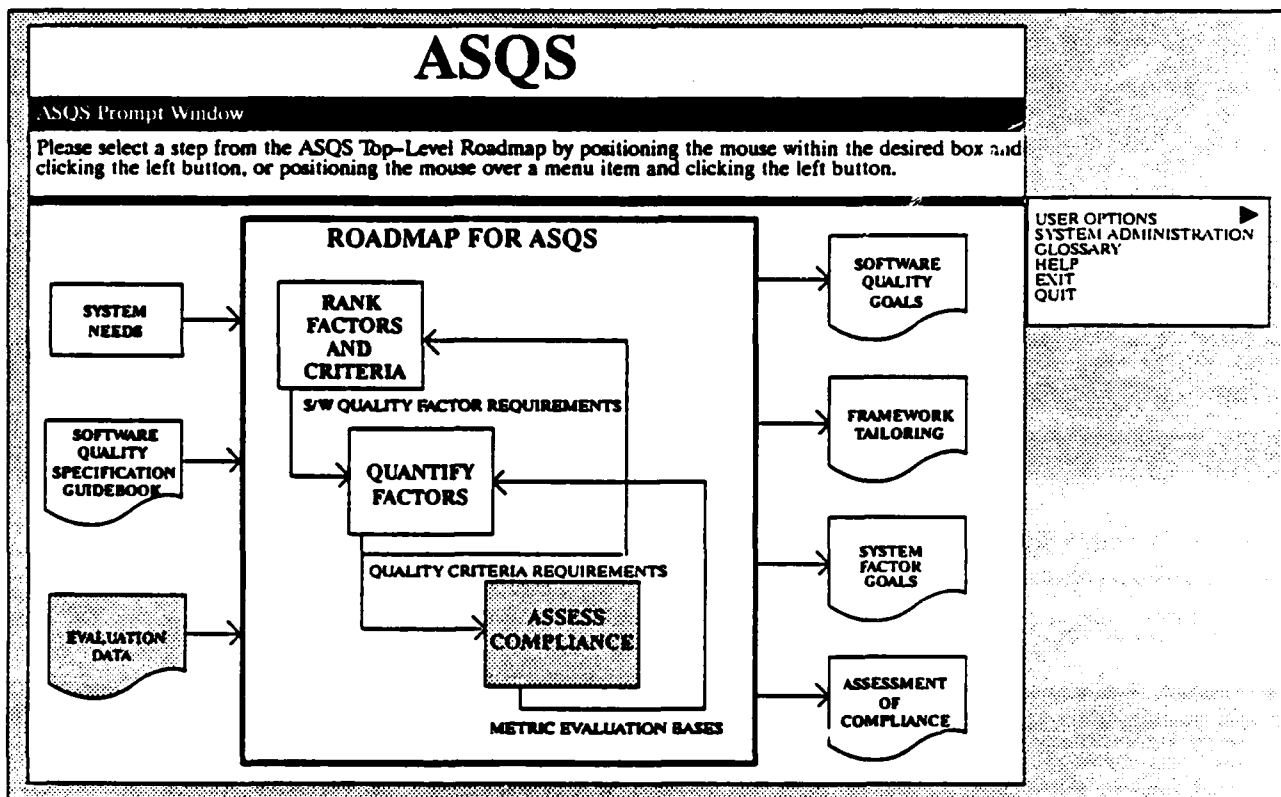


Figure 9.1 Selecting Assess Compliance

## Assess Compliance

Selecting Assess Compliance brings you to the Assess Metrics Option menu. This menu is similar to the Ranker and Qualify Metrics options menus, described earlier in this document. The functions listed operate in the same manner. The focus of the consultation at this point is to generate a qualified and quantified framework, which can be compared to actual evaluation data.

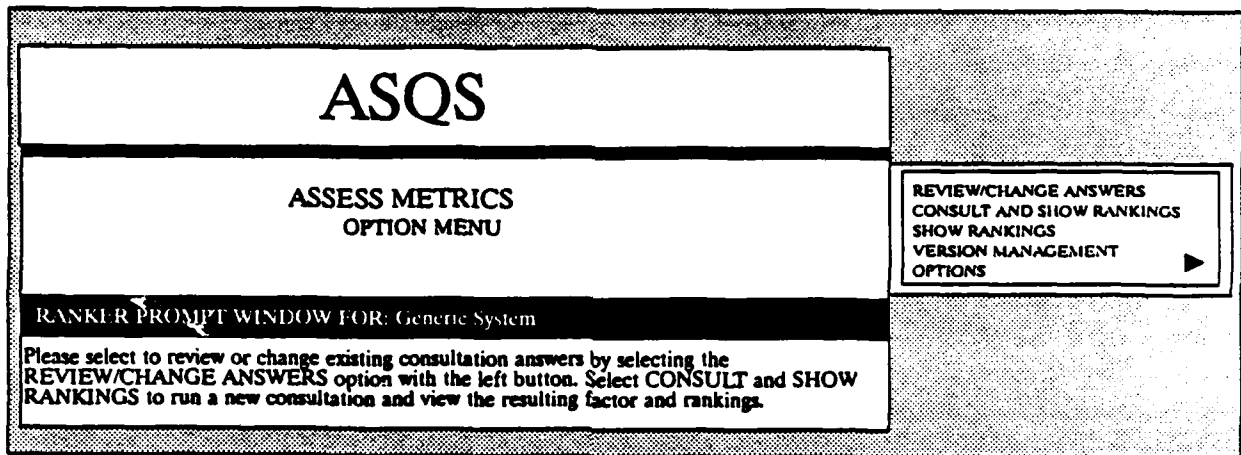


Figure 9.2 The Assess Metrics Option Menu

## Select Function

As with other consultation sessions in the ASQS, you must select specific functions as the focus for the phase of consultation.

ASQS	
SYSTEM DECOMPOSITION FOR Generic System	
Select applicable functions.	
Generic System	<div><div></div><div>FUNCT. CAPAB (25%) INFORMATION STORAGE (25%) INTEGRATION FRAMEWORK (25%) SYSTEM SOFTWARE (25%) HARDWARE (0%)</div></div>

SELECT FUNCTIONS  
DE-SELECT FUNCTIONS  
OPTIONS  
CONTINUE

Figure 9.3 Select Functions for Consultation

## Consult and Show Rankings

Up until this point, the Assessor has looked very similar to both the Ranker and the Quantifier. However, when the factor rankings are displayed, as shown in Figure 9.4, the attached menu shows a new selection, Assessment of Compliance Graph.

ASQS													
Factor Rankings for Generic System													
RANK FACTORS AND CRITERIA													
Assign Factor and Criteria Rankings													
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS													
<div> <div>SOFTWARE QUALITY FACTOR</div> <div>SYSTEM OR SOFTWARE UNIQUE FUNCTION</div> </div>	PERFORMANCE					DESIGN			ADAPTATION				
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
INTEGRATION FRAMEWORK			2-8	2-8									

Show Quantified Framework  
Assessment of Compliance Graph  
How  
Continue

Figure 9.4 Factor Identification Form for Assess Compliance

## Assessment of Compliance Graph

Once you select this option from the attached menu, ASQS prompts you to select a function name from the factor ranking matrix. This brings you to the next step, Select Phase, as shown in Figure 9.5.

ASQS	
<b>ASSESS COMPLIANCE</b> Assess Compliance with Evaluation Data Select Phase	SYSTEM SOFTWARE REQUIREMENTS ANALYSIS SOFTWARE REQUIREMENTS ANALYSIS PRELIMINARY DESIGN DETAILED DESIGN CODING AND UNIT TESTING CSC INTEGRATION AND TESTING CSCI-LEVEL TESTING SYSTEM INTEGRATION AND TESTING OPTIONS ▶
SELECT PHASE WINDOW FOR: Generic System	
Please select a life-cycle phase for reviewing the quantified framework.	

**Figure 9.5 Select Software Life-Cycle Phase**

## Evaluation Data Bar Graph

After calculating the scores and the lower and upper bound goals, ASQS displays a bar graph showing the evaluated factor scores for all thirteen of the software quality factors, as shown in Figure 9.6. Depending on the life-cycle phase (worksheet) selected, the graph will display up to four separate bars for each factor, corresponding to the SYSTEM, TL, CSCI, CSC, and Unit-level metrics, and identified by S, C, T, U on the graph. For example, during the System/Software Requirements Analysis Phase (Worksheet A), only system-level questions are asked, therefore only the SYSTEM bar will be displayed. The ASQS-generated lower and upper bounds appear as lines across the bar graph.

If you select DONE on the attached menu, you will return to the prior step to return to the factor ranking matrix window.

At this point, the user can select any one of the factors (metric identifiers) to view a similar bar graph of all the criteria within the selected factor. This process can be repeated all the way through the framework, until the lowest level (metric element in the hierarchy) is reached. The attached Options menu allows you to return to the previous graph, or return to the top-level graph, or select DONE.

All metric scores lower than the ASQS-generated lower bound will appear as red on the graph. Any score less than the midpoint (established by the algorithm  $\text{midpoint} = \text{upper bound} + \text{lower bound}/2$ ) is displayed in yellow. Any score greater than the midpoint is green. For monitors without color, each color also has a unique hatching pattern (see Figure 9.7).

Any graphs generated by ASQS can be shaped (using the shape command from the Background Utilities Menu) to any desired size. The Move command allows pushing or dragging of the graph window, rather than the individual graphs.

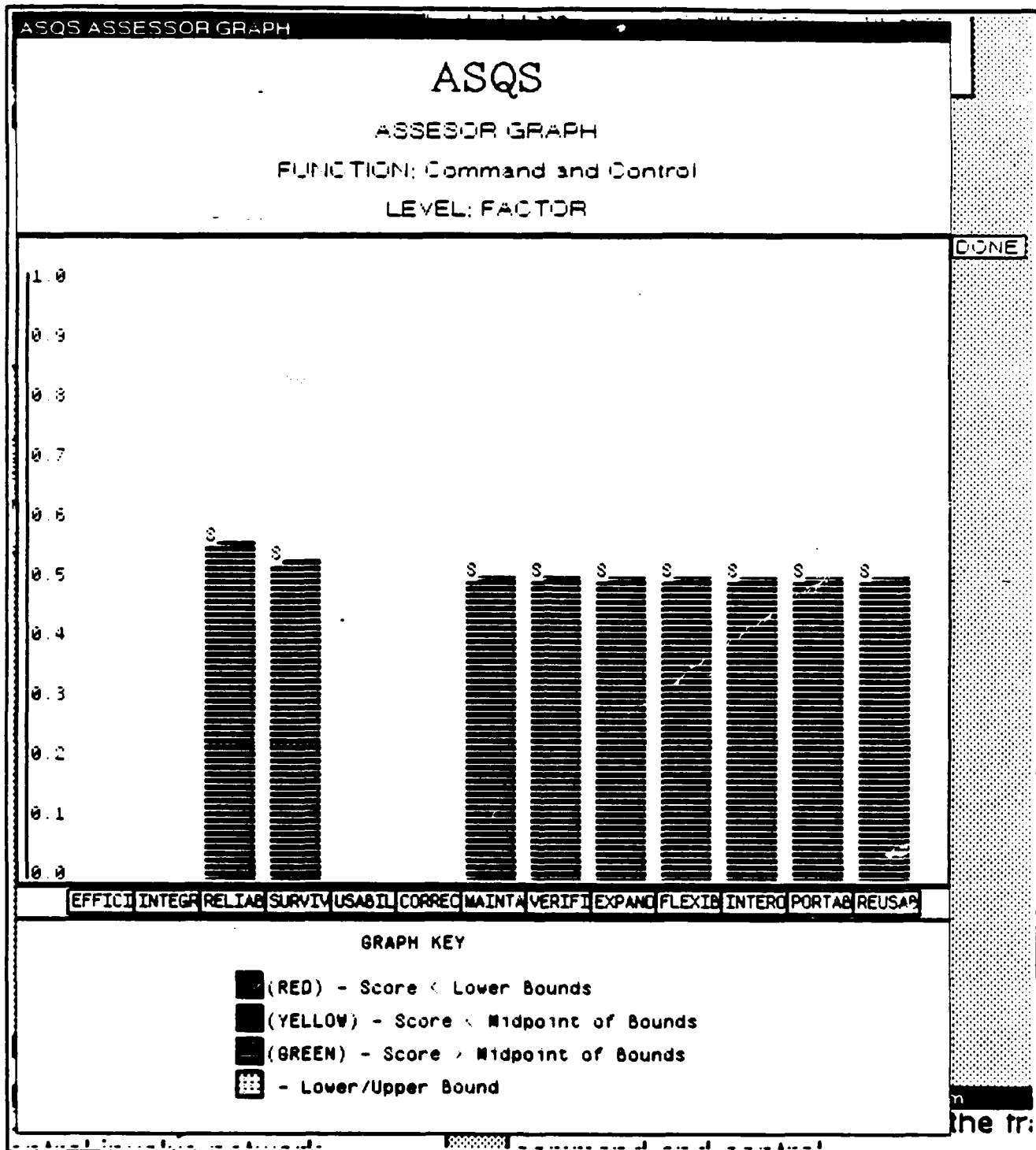


Figure 9.6 The ASQS Assessor Graph Showing All 13 Software Quality Factors



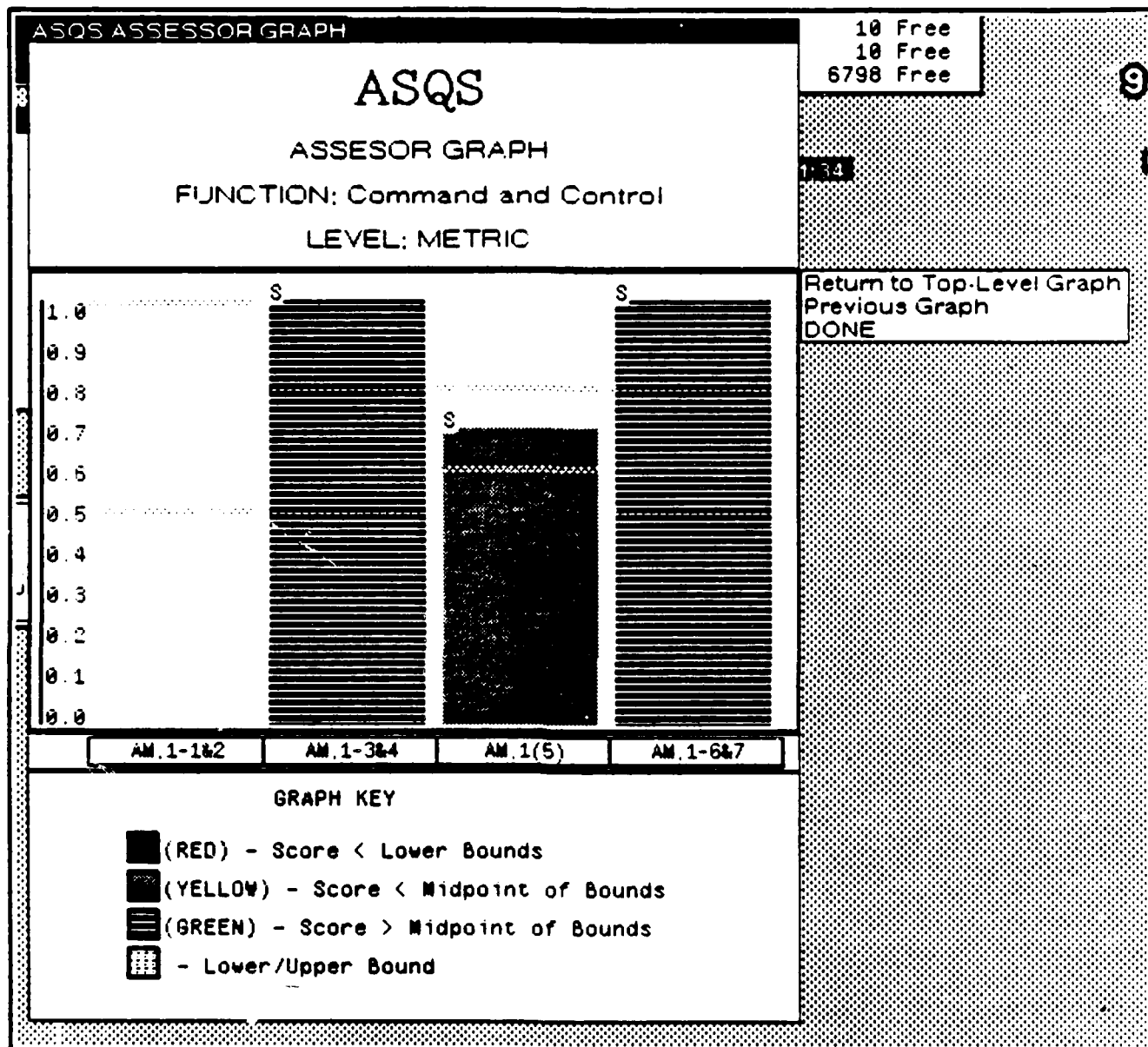


Figure 9.7 The ASQS Assessor Graph Showing Scores at Lower Levels As They Relate to the Established Upper and Lower Bounds

# **Chapter 10**

## **User Needs and Scenarios**

### **Chapter Contents**

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## **How to Use This Chapter!**

The purpose of this chapter is to describe a series of user scenarios. One aspect of the approach is to illustrate each scenario with an example from the STARS Software Engineering Environment. Each scenario is accompanied with a discussion of relevant issues.

These discussions are laid out as a sequence of tasks to be performed, with references to chapters and pages in this manual where a user will find instructions on how to use ASQS to perform the tasks. These references will be placed in parenthesis and underlined as in the following examples: (see Chapter 6), (see page 7-9).

## **Create an initial quality specification prior to full scale development.**

### **Why should a quality specification be done prior to full scale development?**

Ideally, the process of specifying and evaluating software quality should begin prior to Full Scale Development (FSD). Beginning quality specifications during Concept Exploration and carrying it through Demonstration and Validation provides the following benefits:

First, an early start will result in a better quality specification for Full Scale Development, which serves as the starting point for discussions and negotiations with the development and IV & V contractors.

The quality specification is more likely to reflect mission needs, implications of early engineering studies, and the implications of other information gathered prior to Full Scale Development.

Second, early specification helps provide focus for other engineering studies, prototyping and requirements development.

Early rigorous investigation of software quality issues ensures that important software quality concerns are sufficiently investigated.

The knowledge gathered during the engineering studies that is relevant to software quality goals can be formalized using ASQS and incorporated into the ASQS knowledge base. Henceforth, ASQS can act as a project historian, serving as a source for the most up-to-date understanding of software quality issues for the project team.

**What major steps need to be taken in creating this initial quality specification?**

The use of ASQS to specify quality goals prior to FSD is illustrated below by an example for the STARS SEE. In developing an initial specification prior to FSD we are concerned with determining a prioritization of the thirteen software quality factors. The prioritization of the twenty-six software criteria is determined automatically for future use by ASQS during the factor prioritization.

There are four major tasks to be accomplished:

- Task 1 – Identification (Mission area, software type, project)
- Task 2 – Decomposition
- Task 3 – Consultation
- Task 4 – Review Rankings

**Task 1: Identification**

Step 1: Login to ASQS (see Appendix A).

Step 2: At the top-level ASQS roadmap select “Rank Factors and Criteria” (see page 6-4).

Step 3: At the roadmap for Rank Factors and Criteria select “Identify Application/Function” (see page 6-6).

Step 4: Specify the mission area “Software Tools” and the software type “Software Engineering Environments” (see page 7-5).

At this point ASQS already knows a great deal about your project. The knowledge base in ASQS has information regarding the various mission areas and software types.

Step 5: At the Project Window select “Add Project” to add a specification for the STARS SEE. Give an identifier to the system (STARS SEE) and provide a description (see page 7-6).

## **Task 2: Decomposition**

The next window is the System Decomposition Window, which now contains one node for the STARS SEE.

When creating initial specifications there are two situations.

**Step 1a:** If the system is substantially similar to others created in the ASQS System we can utilize some of the decomposition and characteristics of those other systems by using the menu-item **COPY CHARACTERISTICS** (see pages 7-9 and 7-10).

If the STARS SEE were a direct evolutionary outgrowth of another system, we would want to copy the characteristics of that system into our specification and update them for our system. Also, if we were familiar with one of the other systems we might copy similar characteristics from them into our system. This can be a valuable technique to get an initial specification up quickly. It is particularly useful to get a starting point for a new system that is poorly understood (see pages 7-7 and 7-10).

**Step 1b:** If the system is not similar to others created in the ASQS System or if the user wishes first to explore system level needs and their implications for software quality factors before decomposing, then no decomposition at this point would be necessary.

In the case of the STARS SEE we have specific and well understood needs in some areas and prefer to explore them first. In the future we will want to decompose the STARS SEE into system-level functions, but in the early specification stages it is more practical to develop a specification for the overall system. We will return here later to copy characteristics for other areas.

**Step 2:** Since we are done with the System Decomposition Window for now, we select **Continue** (see pages 7-7 and 7-10).

**Step 3:** ASQS will now request that you determine the disposition of the changes that have been made. Select **"Refining/Enhancing."** ASQS will save version 1 of our new system and return us to the Ranker Roadmap (see page 7-12).

### **Task 3: Consultation**

- Step 1:** From the Ranker Roadmap select "Assign Factors and Criteria Rankings" (see page 6-6).
- Step 2:** At the Rank Factors Option Window, we will select "Consult and Show Rankings" to begin a consultation (see pages 7-14 and 7-21).
- Step 3:** Next we are asked to indicate the nodes in the System Decomposition for which to run a consultation (see page 7-15). Since there is only one at this time for the STARS SEE we select STARS SEE.

Now we are ready to begin a consultation to consider system characteristics and needs related to software quality factor priorities. In the process we will find information that must be known or gathered to determine the priorities, and uncover issues and tradeoffs. The JMSNS and POM are possible sources of relevant information. Input to and feedback from other activities such as prototype software development, engineering studies, and requirements definition and planning will contribute to the overall Demonstration and Validation effort.

Suppose we are developing a preliminary SSS during Concept Exploration. The SSS includes a discussion of goals for system quality factors. Information is known about several system level qualities because they are fundamental needs for the STARS SEE (e.g., system availability, usability, and expandability and interoperability). Because the STARS SEE is a software intensive system, we probably want to explore the implications of these and other system level quality factors for software quality factor priorities. This can help clarify the software issues, possibly raising issues that in turn impact the desired system level factor priorities. System quality factors are described in Section 4.1.2.2 of Volume 2 of the Guidebooks. ASQS incorporates questions and rules regarding these factors and their relation to software needs.

- Step 4:** Therefore, we can use ASQS to accomplish our current objective by answering questions about system quality factors. Any other questions that we do not know the answer to, or do not care to address at this time can be answered UNKNOWN. This is a general strategy for running an ASQS consultation which can be employed any time we want to concentrate on only one or a few aspects of the system.

We answer UNKNOWN in the Question Window until a question which asks about whether we want to consult information about system factors appears. We answer YES to this question. Henceforth, we respond with non-trivial answers (i.e., not UNKNOWN) to two kinds of questions. First, to a question which asks directly about the relative level of a system factor, we respond with HIGH, MEDIUM, LOW or Not Applicable (NA). We can attach a comment which provides information about the rationale, origin and depth of knowledge, confidence, requirements (including potential quantitative requirements), references and other relevant information about the level of a system factor. We can also attach a confidence factor to the answer. The confidence and level for a system factor are quite independent. For example, we might expect that a high level is required, but in the early stages of a project, before any studies or prototyping are completed, our confidence in a high level may be very low. In fact, after studies are completed later, we may decide that a medium level is appropriate and attach a higher confidence. If we stay with a high level, we may increase the confidence during a future consultation by using the CHANGE command to re-answer the question.

The second kind of question is asked to determine whether the need for a system factor implies the need for a given software factor. These questions might ask this directly, or gather information which is used by ASQS to determine the nature and extent of these relationships.

Let us consider an example of these two kinds of questions from the STARS SEE. Figure 10.1 shows a question and response to the first form of question, with respect to system availability.

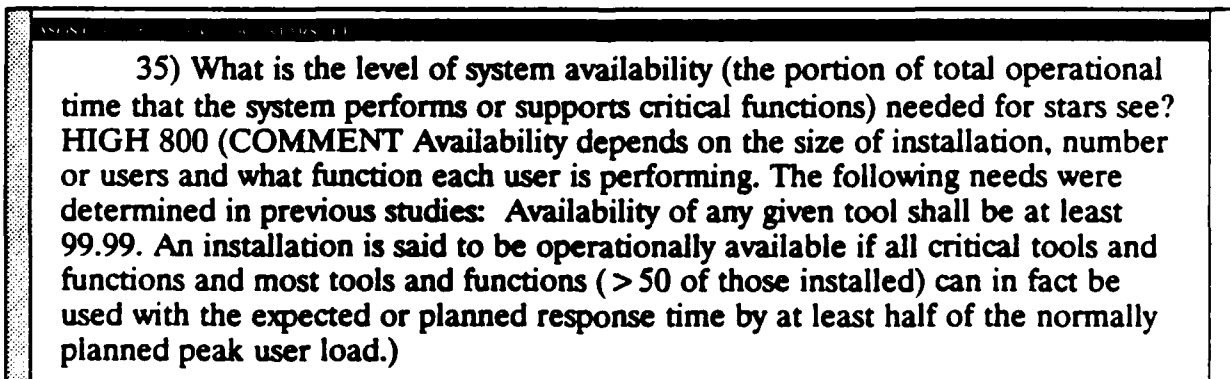


Figure 10.1



Note that there is value in commenting on distinctions between subcomponents of the system (e.g., critical tools and functions versus others) because this information may be useful in the future when further system decomposition is performed. Also, note that the confidence is high (0.8) because of the effort put into defining availability for the STARS SEE in previous studies.

Figure 10.2 shows the second form of question. This addresses the relationship between system availability and software maintainability. Note that the relationship applies more to some aspects of the STARS SEE than others (specifically to non-critical tools). Therefore, we have noted it in a comment and assigned a moderate confidence value of (.5). The ramifications of answering the question yes is that software maintainability will be assigned a ranking according to the rules of combining evidence.

ASOS Consultation log window -- STARS SEE
40) Do software errors detected in stars see need to be quickly located and fixed in order to satisfy system available requirements? YES 500 (COMMENT Especially in the less critical tools. Errors that are detected in the less frequently used tools might be repaired to increase the overall availability of non-critical tools. Critical functions should be designed to be highly available without requiring frequent error fixes.)

Figure 10.2

#### Task 4: Review Rankings

**Step 1:** At the end of the consultation, we can review the software quality factor priorities implied by high levels of system availability, expandability, interoperability and usability (see Figure 10.3). At this time unexpected or extreme rankings should be reviewed (see pages 7-29 and 7-30).

For example, we might review Reliability and Verifiability using the explanation facility (see page 5-19) to find out how these factors were added (notice that no ranking was entered for the corresponding system factors.) Selecting the "G" under Reliability we obtain a response in the Why Window. By exploring the reasoning deeper, we find that software Reliability was implied by the need for system availability.

ASQS													
FACTOR RANKINGS FOR STARS SEE													
RANK FACTORS AND CRITERIA													
Assign Factor and Criteria Rankings													
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS													
<div> <div>SOFTWARE QUALITY FACTOR</div> <div>SYSTEM OR SOFTWARE UNIQUE FUNCTION</div> </div>	PERFORMANCE					DESIGN			ADAPTATION				
	E F F I C I E N C Y	I N T E G R I T Y	R E L I A B I L I T Y	S U R V I V A B I L I T Y	U S A B I L I T Y	C O R R E C T N E S S	M A I N T A I N A B I L I T Y	V E R I F I A B I L I T Y	E X P A N D A B I L I T Y	F L E X I B I L I T Y	I N T E R O P E R A B I L I T Y	P O R T A B I L I T Y	R E U S A B I L I T Y
STARS SEE	L		M	L	M		L	M	M	L	M	L	

Figure 10.3

The information provided in the Factor Ranking Window helps guide future investigations or studies. One aspect of this is that it may suggest the next steps for building a quality specification using ASQS. For example, many of the software quality factors with rankings for the STARS SEE are also system quality factors.

- Step 2:** One path for future investigation is to consider which of these rankings apply at the system level and therefore should be added to the list of system quality factors for the STARS SEE.

As an example, consider that software reliability is implied by system availability. This in turn suggests that system reliability is important, since the STARS SEE is software intensive, and since hardware reliability is important for meeting availability requirements. In order to add system factors in this way, we might snap the current Factor Ranking Window to keep a record of the possible factors, and rerun a consultation, answering the appropriate system factor-related questions as they appear. When we are done, we might want to use the Answer Window with the system factors selected in order to review which system factors have been added, or to make changes.

The goals can be incorporated into the CRLCMP, and in the preliminary SSS, to the extent that the software quality goals affect system quality goals (i.e., considering hardware as well as software). This is usually the case in a software intensive system. The goals can again be incorporated into the updated CRLCMP and SSS. Also, the software quality factor goals can be incorporated into the quality factor sections of a preliminary SRS.

- Step 3:** Another path for future investigation is to choose one of the higher ranked software factors for further study. This might mean a special study outside of ASQS (e.g., a Reliability study) or answering Reliability-related questions as they appear.

In general, if one does not know if a question is Reliability-related one can use the WHY option (see page 7-22) to find out. When the answer to such a question is not known, it is cause for further discussion or study. We will explore the case of answering Reliability-related questions.

## **Revise quality goals due to factor interrelationships**

The process of considering factor interrelationships encourages the development of an internally consistent quality specification. Based on the recommendations provided by ASQS, we may want to modify our initial answers given during the earlier consultations (e.g., reflect a change in development approach or less stringent requirements). Changes in answers can have a rippling effect, in that they introduce new implications, possibly resulting in new interrelationships and further changes in answers. Therefore, it is important that the factor interrelationships are considered early during the overall specification development. If one waits until a large number of answers have been given for a function (e.g., more than 50), the user may find that more iterations and refinements are required to complete the overall specification.

There are four major tasks to be accomplished:

- Task 1 – Identification (Mission area, software type, project)
- Task 2 – Consultation
- Task 3 – Review Revised Rankings
- Task 4 – Respond

### **Task 1: Identification**

Step 1: Login to ASQS (See Appendix A).

Step 2: At the top-level ASQS roadmap select “Rank Factors and Criteria” (see page 6-4).

Step 3: At the roadmap for Rank Factors and Criteria select “Identify Application/Function” (see page 6-6).

Step 4: Specify the mission area and the software type (see page 7-4).

At this point ASQS already knows a great deal about your project. The knowledge base in ASQS has information regarding the various mission areas and software types.

Step 5: At the Project Window select your project (see page 7-6).

## **Task 2: Consultation**

- Step 1:** To consider factor interrelationships, we begin by selecting **Rank Factors and Criteria** at the top-level ASQS roadmap (see page 6-4).
- Step 2:** **Select Revise Rankings Based on Interrelationships** on the Ranker Roadmap (see page 6-6).
- Step 3:** Next, we select **Consult and Show Rankings** from the Ranker Option Window (see page 7-21).
- Step 4:** Select the "STARS SEE" function from the Select Functions Window (see page 7-15).

There is only one function at this time. When there is more than one function in a more mature specification, it may be desirable to consider interrelationships for only one of the functions. In this way similarities can be exploited by using the copy characteristics option of the System Decomposition Window to copy interrelationship characteristics to other functions and refine them individually as needed.

- Step 5:** Answer the questions that are asked during the consultation. They are designed to determine the nature and extent of interrelationships between factors for the selected function(s). Currently, many of the questions are of a form which asks directly about the relevance of a specific interrelationship between a criteria and a factor to a given function. For example, "Does good anomaly management (those characteristics which provide for continuity of operations and recovery from non-nominal conditions) reduce operator workload for the STARS SEE?" Operator workload corresponds to the factor Usability in this example. This form of question is based on the contents of Tables 4.1.3.2 and 4.1.3.3 in Volume 2 of the Guidebooks. The questions derived from this table are general in nature and usually the answer will be yes indicating that the relationship does apply for the target function. For this reason, it may be desirable to copy the interrelationship characteristics from the generic system (see page 7-10) and review them for changes using the Answer Window rather than answering the questions one by one during the consultation.

As the knowledge base matures, more of the questions will address specific characteristics of the function which determine whether an interrelationship applies, so that answers to the higher level questions can be inferred rather than asked directly.

### Task 3: Review Revised Rankings

**Step 1:** At the end of the consultation, we can review the interrelationships shown in the Factor Ranking Window. Continuing with the knowledge base resulting from scenario 1, we find interrelationships as shown in Figure 10.4. (See pages 7-31 and 7-32.)

The interrelationships are denoted by the “+n” and “-n” annotations following the ranking. The “n” denotes the degree of evidence (a number between 0 and 10, where 10 indicates certainty (i.e., a confidence of 1.0)). A “+” indicates that the factor’s presence contributes to other desired factors (i.e., either it improves the observed quality with regard to that factor, or it eases the difficulty of achieving that factor).

ASQS													
FACTOR RANKINGS FOR STARS SEE													
RANK FACTORS AND CRITERIA													
Assign Factor and Criteria Rankings													
SOFTWARE QUALITY FACTOR IDENTIFICATION FORM - INITIAL GOALS													
SOFTWARE QUALITY FACTOR	PERFORMANCE					DESIGN			ADAPTATION				
	EFFICIENCY	INTEGRITY	RELIABILITY	SURVIVABILITY	USABILITY	CORRECTNESS	MAINTAINABILITY	VERIFIABILITY	EXPANDABILITY	FLEXIBILITY	INTEROPERABILITY	PORTABILITY	REUSABILITY
SYSTEM OR SOFTWARE UNIQUE FUNCTION													
STARS SEE	L-3		H+4	M+1	M	M+6	L	M	M	L	M	L	

How  
Continue

Figure 10.4

**Step 2:** For example, consider the annotation for Reliability. We can use the explanation facility to examine the reason for the annotation by asking HOW.

We find that Reliability is needed because of the reasons given during Assign Factor and Criteria Rankings, but also, that one of the rules indicates that Reliability is needed because having Reliability increases the overall consistency of the specification with regard to other desired factors. If we chase down the explanation further by going deeper into this reasoning chain, we will find that one of the reasons that Reliability is needed is because it enhances the observed usability. Specifically, we find that good anomaly management (one of the criteria of Reliability) reduces operator workload (a Usability consideration).

A “-” indicates that with the other factor goals, the annotated factor goal will be more difficult, or even impossible to achieve. For example, consider the annotation for Efficiency. If we use the explanation facility to examine the reasons for the annotation, we find that Efficiency of the STARS SEE is not recommended for overall consistency of the factor goals with respect to factor interrelationships. This means that, although there may be other reasons for Efficiency, and in fact it might be necessary, the interrelationships with other factors increase the difficulty of achieving Efficiency. Exploring further down the reasoning chain we find that increased generality (a criteria of Expandability) results in less Efficiency.

**Step 3:** When a “-” annotation appears we probably want to review the reasons for needing that factor in the first place. A “-” indicates a potential problem area in achieving the overall goals (i.e., a development problem). We can review the original reasons by using the explanation facility at the current window, since these reasons are preserved during the Interrelator.

#### **Task 4: Respond**

In the case of the STARS SEE, we find that one of the reasons for needing Efficiency is as follows: 1) the system factor Expandability is needed, 2) the STARS SEE was considered a capability-limited system in the original consultation. When 1 and 2 hold, there is a need for software Efficiency to provide for overall system Expandability.

**Step 1:** Reconsider answers using the Answer Window (see pages 7-15 to 7-20).

Considering the difficulty of achieving software Efficiency with the other software goals, we might want to reconsider our answer to whether the STARS SEE is capacity-limited. This can be accomplished by going to the Answer Window, selecting **Application Characteristics**, and modifying the answer for the parameter **CAPACITY-LIMITED**. Our new answer might be as follows: "NO (.6) (COMMENT Because of recent, significant advances in computing power and reduced hardware costs, and because there are no physical size or weight restrictions, the STARS SEE is not considered to be a capacity-limited system. Therefore, software Efficiency need not be emphasized if system efficiency can be achieved by sufficient computing hardware.)".

**Step 2:** Rerun a consultation after changing any answers (see pages 7-21 to 7-28).

Now if we rerun the consultation in the Interrelator, we will find that software Efficiency is no longer denoted as a goal (i.e., indicated by a blank item). In general, when a negative factor interrelationship occurs we can either reconsider the reasons for needing the factor (as we have done), we can reconsider the reasons for needing the affecting factors, or we can reconsider the reasons given for the interrelationships. In any event, a reconsideration usually means that the user has gained a better understanding of the issues involved in determining factor priorities, or a better understanding of the desired software development priorities.



## **Decompose system functions and assign quality goals to lower levels.**

### **Why assign quality goals to lower levels?**

Once the target system matures to the point where a functional break-out emerges, it may be desirable to begin the specification of software quality goals at a lower level. Specifying quality goals for a decomposition of the overall system provides the benefit that distinctions can be made between the needs and characteristics of individual functions. Just as different sub-functions of an overall system may have very different functional requirements, they may also have very different quality requirements. Sub-functions differ in their needs (including different cost, performance and supportability goals) and in their system and software characteristics (including the supporting hardware, functional characteristics, development characteristics and even environment characteristics). Therefore, in the interests of creating a meaningful quality specification against which the software can be evaluated, it is usually desirable to decompose the overall system into sub-functions.

### **What is a decomposition?**

As the software development life cycle progresses, ASQS can be used to further decompose the quality specification. Initially a system would be decomposed into system functions. Software functions with unique needs or characteristics may also be called out. The top-level functions may be decomposed further into lower-level functions and so on. When Computer Software Configuration Items (CSCI's) are identified, the functions can be broken down into CSCI's. Since ASQS treats all levels in the system decomposition uniformly (as nodes in a decomposition tree), it can be used to represent the decomposition into CSCI's and to develop the associated quality specification. In fact, further decomposition into TLCSC's, LLCSC's and even units is supported by ASQS. The description attached with each node can include a denotation of the type of item of each node in the system decomposition.

### **How much decomposition is enough?**

Since it is possible to decompose a system to the unit level within ASQS, it is important to consider carefully the level of function decomposition. Certain constraints, such as the cost of specifying and evaluating the software at a lower-level, may limit the number of functions that can reasonably be evaluated. The level of decomposition should be low enough to make key distinctions between functions. Finally, it should be noted that a quality specification decomposition that matches the formal decomposition documented in the system documentation is most desirable. Decompositions that differ complicate the process of relating the evaluation data to the specification goals.

### **When should a system be decomposed?**

It is usually best to decompose the system only after no more meaningful information can be added at the higher level. This is because the same question must be answered for each sub-function. If the answers are the same for each sub-function it is more efficient to give the answer before the system is decomposed. When the system is decomposed these uniform answers will be automatically inherited by the sub-functions, eliminating the need to provide the same answer multiple times.

There are four basic tasks to be accomplished:

- Task 1 – Identification (Mission area, software type, project)**
- Task 2 – Decomposition**
- Task 3 – Review Answers**
- Task 4 – Review Rankings**

### Task 1: Identification

Step 1: Login to ASQS (See Appendix A).

Step 2: At the top-level ASQS roadmap select "Rank Factors and Criteria," (see page 6-4).

Step 3: At the roadmap for Rank Factors and Criteria select "Identify Application/Function" (see page 6-6).

Step 4: Specify the mission area and the software type (see page 7-4).

At this point ASQS already knows a great deal about your project. The knowledge base in ASQS has information regarding the various mission areas and software types.

Step 5: At the Project Window select your project (see page 7-6).

### Task 2: Decomposition

Step 1: We begin to decompose the STARS SEE by selecting Decompose from the System Decomposition Window.

Step 2: Add each of the functions as we are prompted and provide a description of each.

We decided to add a node to represent the Hardware function for the sake of completeness (see Figure 10.5). We can use the Change Weight command to indicate the contribution of each function to the overall quality of the STARS SEE. We decided to weight the functions equally for now, except for the Hardware function which naturally receives a weighting of 0%.

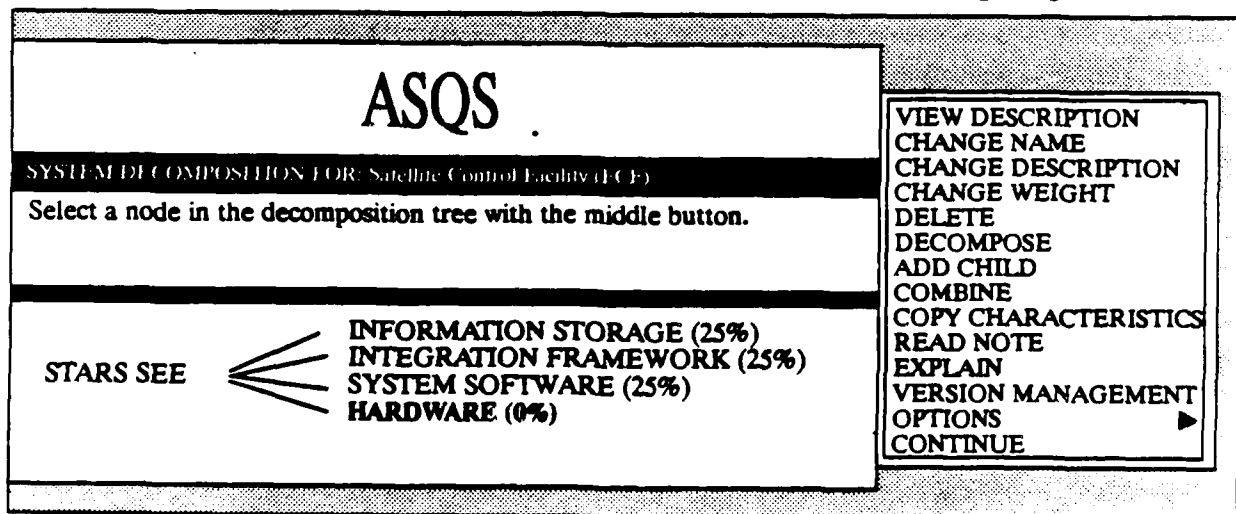


Figure 10.5

### **Task 3: Review Answers**

After decomposing, each of the new sub-functions has the same answers for the consultation as the parent did originally. Now we want to review those answers for each sub-function and refine them to distinguish between the sub-functions.

**Step 1:** Select the set of sub-functions and the category of characteristics to be reviewed (see pages 7-15 to 7-20).

**Step 2:** Go to the Answer Window to review and change answers (see pages 7-15 to 7-20).

Since we developed our initial specification based on system factors in scenario 1, we select the system factors for review. We can choose to review each function one at a time in the Answer Window or select all of them for display at one time in the Answer Window. We decide to select all of the functions since the number of system factors entered during previous consultations is small (four – availability, expandability, interoperability and usability). This allows us to easily determine appropriate differences between functions by reviewing them all in the same Answer Window.

We find that for each of the functions and each of the system factors the answer is HIGH (indicating a HIGH level of system quality factor). We know that although the level for the overall system should be HIGH, some of the functions need not have a high level of system quality factor. For example, usability is not particularly important for the System Software because it does not interface directly to the end users of the STARS SEE. System administrators may in some cases interface to the System Software, but they are well trained and can easily work with more esoteric types of interfaces. Therefore, we lower the answer for SYSTEM-USABILITY-IS-NEEDED to LOW and denote the reason with a comment. Similarly, interoperability, although HIGH for all of the functions, is most important for the Integration Framework function, so we reanswer this question with an answer of HIGH and raise the confidence from .8 to 1.0. Other appropriate changes are made accordingly.

#### **Task 4: Review Revised Rankings**

At this time, we want to review the new software quality rankings which resulted from the changed answers, and compare those results to the rankings before the answers were changed

- Step 1:** We go to the Ranker Option Window and select **Show Rankings** (see page 7-29).
- Step 2:** Take a snapshot of the Factor Ranking Window, (see page 3-4).
- Step 3:** Finish the consultation.
- Step 4:** Indicate in the Version Disposition Window that the changes were made to refine the specification (adding appropriate descriptions of why when prompted) (see page 7-12).
- Step 5:** Go to the Version Management Window from the Ranker Option Window, and back up to the previous version by selecting **Reset Current Version** (see page 7-11).
- Step 6:** Rerun the consultation for that version with the option **Show Rankings**. The resulting Factor Ranking Window gives the old rankings for comparison.
- Step 7:** When we are done, we must remember to return to the original version before making additional changes.

We may also want to revise the rankings based on interrelationships again. Refinements should be made interactively until the distinctions between functions are completely made. An organized way to do so is to make changes to each of the relevant groups of characteristics in the Characteristic Select Window one at a time and run a follow-up consultation to review the ramifications.

- \* **Note:** we might want to snap these rankings and shrink them into an icon in case we want to review them again at a later time.

## **Revise goals based on greater knowledge of the system.**

Suppose at a later stage of the development life-cycle, we have gathered information regarding security-related issues and some thought has been given to the allocation of security functionality to individual functions. This might result from a special study during the Demonstration and Validation phase for example. We want to incorporate the new information into the ASQS knowledge base in order to consider the ramifications to the quality specification.

There are two major tasks to be accomplished:

- Task 1 - Identification
- Task 2 - Consultation

### **Task 1: Identification**

- Step 1: Login to ASQS (See Appendix A).
- Step 2: At the top-level ASQS roadmap select Rank Factors and Criteria (see page 6-4).
- Step 3: At the roadmap for Rank Factors and Criteria select Identify Application/Function (see page 6-6).
- Step 4: Specify the mission area and the software type (see page 7-4).

At this point ASQS already knows a great deal about your project. The knowledge base in ASQS has information regarding the various mission areas and software types.

- Step 5: At the Project Window select your project. (see page 7-6.)

## **Task 2: Consultation**

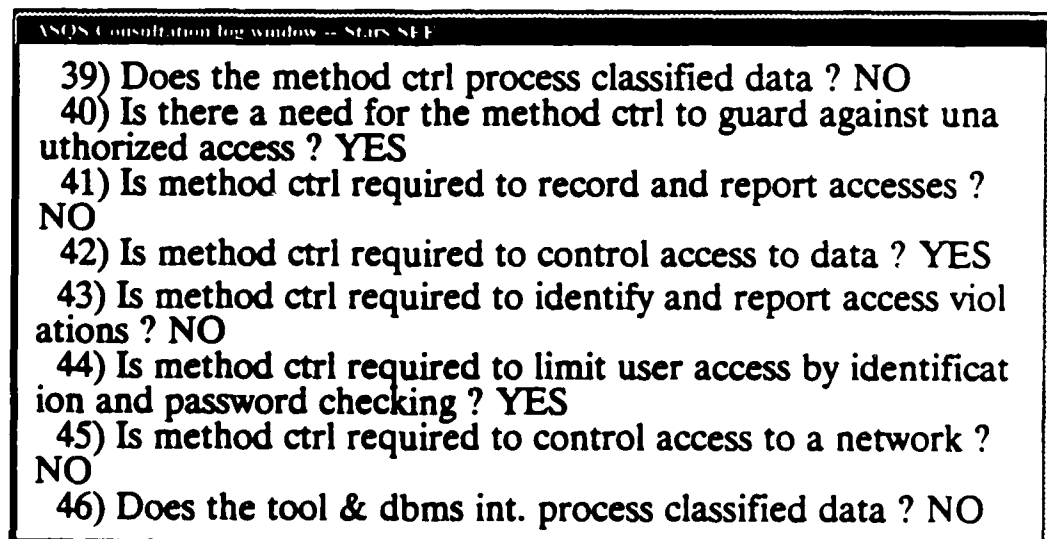
**Step 1:** We begin by selecting a representative function which involves security functionality (see page 7-15).

**Step 2:** To do this we run a consultation and answer the relevant questions as they appear, while answering other questions that are not related to information gathered in the study with the answer UNKNOWN (see page 7-21 to 7-28).

For example, in the STARS SEE we know that the Integration Framework is going to have functionality to guard against unauthorized access to the data base, interfacing tools, or communications networks. Therefore, we can run the consultation for Integration Framework and answer relevant questions.

Figure 10.6 shows a series of questions from the consultation related to security functionality. We have identified a data presentation capability (data presentation is one of the software categories) called method control. It is part of the Integration Framework responsible for controlling the methodology of how tools and services are used by different kinds of users. The questions are answered according to our understanding of method control.

At the end of the consultation, we find that the software quality factor Integrity is added to the list of factors needed in the Factor Ranking Window. The need for Integrity is based on a detailed understanding of security-related functionality.



**Figure 10.6**

After the Integration Framework refinement is completed, we want to refine other functions. We begin with the Information Storage function, which potentially stores classified data. Rather than answer questions one-by-one during a consultation, we elect to copy functional characteristics from the Integration Framework function to the Information Storage function. This makes sense because many of the functional characteristics are the same. Next, we go to the Answer Window, selecting the Integration Framework and Information Storage functions for review. The characteristics selected are the Functional Characteristics. The Answer Window gives us a snapshot for review of the functional characteristics, including the security functionality questions. Here we can make decisions of how to allocate high-level functional requirements between the two functions. For example, we may elect to make the Integration Framework responsible for identifying and reporting access violations rather than the Information Storage function to increase the likelihood of finding an off-the-shelf data base management system which will support the requirements of the Information Storage function. In this way the Answer Window provides a convenient way to represent conceptual decisions about functional requirements, forming a conceptual model of the system.

The ramifications of these decisions on software quality can be reviewed in the Factor Ranking Window after a consultation is run. This allows one to consider issues such as the feasibility and difficulty of achieving desired quality levels with various proposed conceptual models of the system. For example, we can perform a what-if type of analysis by evaluating alternative allocations of the security-related functions to the Integration Framework and Information Storage. Figure 10.7 shows a comparison of the characteristics for Information Storage and the Tool and DBMS Interface of the Integration Framework.

Tool and DBMS Interface is another one of the data presentation capabilities identified during the consultation. Comparing these two functions allows one to examine the allocation of security-related characteristics to sub-functions of the system (from NEED-TO-GUARD-AGAINST-UNAUTHORIZED-ACCESS through REQUIRED-TO-RECORD-AND-REPORT-ACCESS-VIOLATIONS).

Reviewing the resulting rankings and factor interrelationships may uncover considerations heretofore undiscovered, which can be incorporated into a refined conceptual model. This approach provides for consideration of software quality issues along with the development of the functional architecture.



ASQS		<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> CHANGE ANSWER  DELETE ANSWER  READ NOTE  EXPLAIN  CHANGE EXPLANATION  OPTIONS <span style="float: right;">▶</span> </div>
ANSWERS FOR STATUS		
SOFTWARE-FUNCTION-NAME	INFORMATION STORAGE INTEGRATION FRAMEWORK	
CONFORMANCE TO SOFTWARE SPECIFIC. CONSULT SYSTEM FACTORS CRITICAL FAILURES REQUIRE SOFTWARE LOW FREQUENCY OF SOFTWARE ERROR SOFTWARE ERRORS MUST BE LOCATED SOFTWARE FUNCTION SYSTEM AVAILABILITY IS NEEDED SYSTEM RELIABILITY IS NEEDED UNAUTHORIZED ACCESS ADVERSELY APT CAPABILITY NAME NEED TO GUARD AGAINST UNAUTHORIZED PROCESSES CLASSIFIED DATA REQUIRED TO CONTROL ACCESS TO DAT REQUIRED TO CONTROL ACCESS TO NET REQUIRED TO IDENTIFY AND REPORT AC REQUIRED TO LIMIT USER ACCESS BY ID REQUIRED TO RECORD AND REPORT ACC DATABASE MANAGEMENT MS SR	<div style="display: flex; justify-content: space-between;"> <div> YES YES YES YES YES YES data base management HIGH MEDIUM YES  YES YES YES  NO  YES </div> <div> YES YES YES YES YES YES user interface HIGH MEDIUM YES Test &amp; DEMOS int YES NO YES YES YES YES YES </div> </div>	

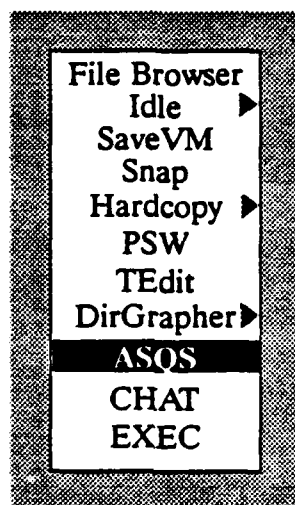
Figure 10.7

## APPENDIX A

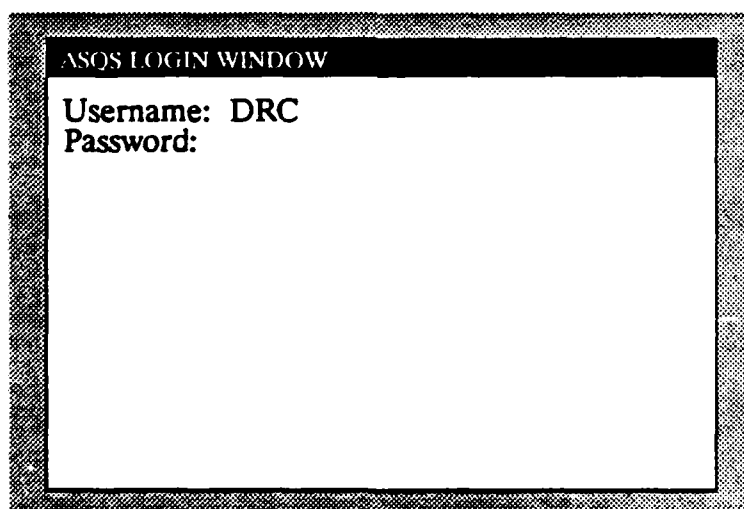
### Login and Restart

#### Login

Select ASQS from the Background Menu.



The Login window will appear.



Enter your user name in response to the prompt.

Enter your password in response to the prompt.

The ASQS Roadmap will appear.

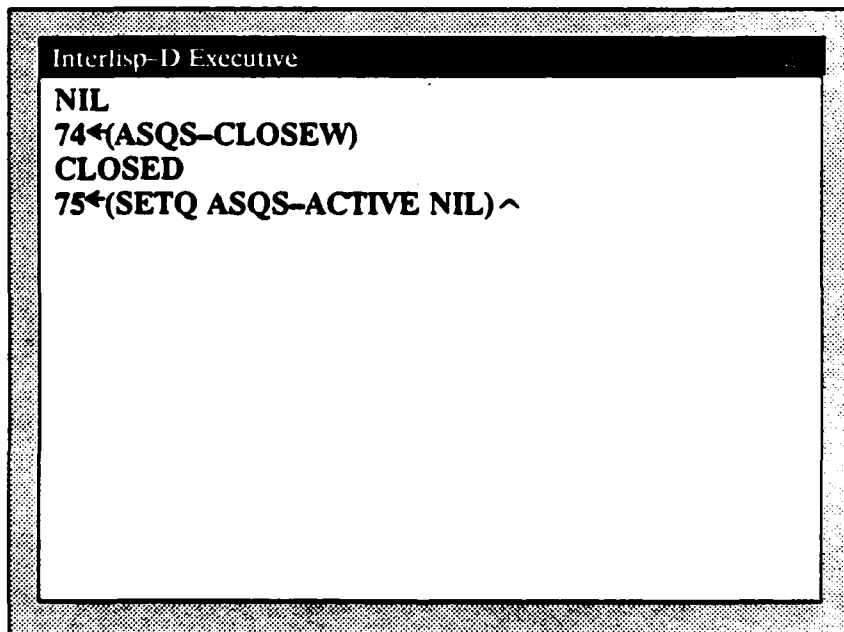
## Restart

To prevent accidental execution of two ASQS's simultaneously, which occurs under some conditions, it is necessary to restart the ASQS tool.

A "hung" system which will not respond is the most common symptom of this situation.

When this occurs, do the following:

- 1) Select the Interlisp-D Executive Window. (Note the flashing carat.) If the window is not open, select EXEC from the Background Utilities Menu.
- 2) Move the screen pointer to an area within an open ASQS window.
- 3) Type: (ASQS-CLOSEW)
- 4) Repeat steps 2 and 3 until all ASQS windows are closed.
- 5) Type: (SETQ ASQS-ACTIVE NIL)
- 6) Select ASQS from the Background Menu and Login again.



## **APPENDIX B**

### **ASQS Glossary of Terms**

#### **A**

**Advanced decision system** – a system such as a MAC Command and Control Information Processing System.

**Add Child** – one of the System Decomposition Window choices allowing the user to add a new subfunction to an existing node on a System Decomposition Tree.

**Aircraft software** – all software for aircraft operations excluding flight control software.

**Answer Window** – ASQS-generated window appearing during the Review/Change Answers Process on the Ranker Option Menu when the user selects Continue after selecting characteristics for review. The window shows both the characteristics selected and the current answers allowing the user the opportunity to change the answers given previously, using the choices on the attached menu (see Change Answer, Delete Answer, Read Note, Explain, Options sub-menu).

**Application characteristics** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to select software characteristics related to the nature of the application. For example, "Does failure to produce a correct result affect human lives?"

**Armament** – one of the mission areas listed on the attached menu for the Mission Area Selection Prompt Window. Armament includes software and systems developed for tactical systems, such as threat, guided weapon, and scoring systems.

**ASQS** – Assistant for Specifying the Quality of Software, a Xerox workstation-based expert system for specifying requirements for software quality goals and tailoring a metrics framework.

**ASQS Roadmap** – the top-level Roadmap Window in ASQS, reached upon log in to ASQS and from which the user selects routes to ASQS's three main functions (Roadmaps – see Ranker Roadmap, Quantifier Roadmap, and Assessor Roadmap).

**Assess Compliance** – the ASQS Roadmap selection to access the Assessor Roadmap. One of the top-level functions of ASQS. This ASQS function compares the ASQS-generated software quality goals with evaluated software quality scores as returned by the Quality Evaluation System (QUES).

**Assess Compliance with Evaluation Data** – once selected, prompts the user to select a function name from the factor ranking matrix. The next step is to Select Phase.

**Assess Metrics Option menu** – see the Ranker Option menu. The focus of the consultation at this point is to generate a qualified and quantified framework, which can be compared to actual evaluation data.

**Assessor Roadmap** – an ASQS-generated window for the function Assess Compliance, where users determine the degree to which software complies with stated goals.

**Assign Factors and Criteria Rankings** – one of the selections on the Ranker Roadmap, where users develop and refine the quality specification (see Ranker Option Menu).

**Attached menu** – option menus or sub-menus attached to the side of an ASQS-generated window.

**Avionics/Airborne Systems** – one of the mission areas listed on the attached menu for the Mission Area Selection Prompt Window. Avionics/Airborne Systems includes software and computers developed for aircrafts, including simulators, flight control and reconnaissance, and electronic warfare software.

## **B**

**Banner Window** – an ASQS-generated window displaying the name of the current level and/or option most recently selected, the name of the project on which the user is working, and an attached menu of options for proceeding.

**Baseline** – an upper or lower bound for metric elements, quality criteria, and quality factors in a tailored framework, in a range established by ASQS, using information supplied or inferred from user response, consultations, projects within the same mission areas, and projects not necessarily within the same mission area (see Quantify Metrics).

**Bury** – Xerox option on Window Utilities Menu allowing users to move a window to the bottom of a stack of overlapping windows.

## **C**

**CF** – a selection on the ASQS Question Window, which users select to enter a confidence level, or Certainty Factor, before entering answers. The CF is a scroll bar window appearing on the left side of the Question Window when users select CF. The Consultation Log Window records the CF and any comments as a permanent part of the consultation record. Confidence Factors range from -1 (absolute confidence that an answer is incorrect) to +1 (absolute confidence that an answer is correct). When a CF is greater than -.2, but less than +.2, it is of insufficient strength for ASQS to draw conclusions using the CF.

**Change** – a selection on the ASQS Question window, which users select to change an answer. The system prompts the user for the number(s) of the question(s) requiring a new answer, a number obtained from the text in the Consultation Log Window.

**Change Answer** – one of the choices on the attached menu for the Answer Window, part of the Review/Change Answers process, allowing users to select an answer to change it.

**Change Name** – one of the System Decomposition Window choices allowing the user to change the functional description of a node on the System Decomposition Tree.

**Change Weight** – one of the System Decomposition Window choices allowing the user to change the weighting (indicating relative importance of the node to the system/project) of a function node selected from the System Decomposition Tree.

**Characteristic Selection Prompt Window** – part of the Ranker Review/Change Answers process, allowing the user to select characteristics and other information for review or changes (see Application Characteristics, Environment Characteristics, Development Characteristics, Functional Characteristics, Data Presentation, Database Management, System Factors, Survey Results, and Options sub-menu). Also known as the Context Selection Prompt Window.

**Child** – a subfunction of a function, or a function of a system on the System Decomposition Tree. A lower-level node is the child of the higher-level node.

**Clear** – Xerox option on Window Utilities Menu allowing users to clear the contents of a window containing text and messages.

**Close** – Xerox option on Window Utilities Menu allowing users to close a user-generated window (where allowed by ASQS).

**Coding and Unit Testing** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where design is coded into units and tested.

**Command Control and Communications** – one of the mission areas listed on the attached menu for the Mission Area Selection Prompt Window. Command Control and Communications includes software and computers for systems or system components covering command, control, and communication functionality, such as war planning, and warning and intelligence systems.

**Comment** – a selection on the ASQS Question Window, which users select to enter comments in response to system prompts. Comments are aids to understanding and explanatory information for future reference.

**Compare Goals With Project Data** – one of the options on the Quantifier Roadmap allowing users to compare software goals with data from previous projects with similar characteristics. The comparison is a “reasonableness” test (without statistical analysis), comparing the Achieved Factor Rankings of the previous projects with the expected quality scores for this project.

**Compiler** – a utility for translating software code into machine language, which may also include support of additional development and diagnostic utilities and tools in a software development environment.

**Conclusion, ASQS** – the decision(s) ASQS reaches in response to user answers during a consultation in conjunction with information already contained in the ASQS knowledge/rule base.

**Conclusion Window** – an ASQS-generated window on the Consultation screen, displayed upon user selection of Consult and Show Rankings, allowing the user to automatically log all non-trivial conclusions and inferences regarding the quality specification. ASQS displays a confidence level in the conclusion in parentheses for each answer.

**Consult and Show Rankings** – One of the options on the Ranker Option Menu allowing users to run a consultation and view the resulting rankings. The selection opens several ASQS windows concurrently (see Factor Gauges Panel, Question Window, Why Window, Consultation Log Window, and Conclusion Window).

**Consultation, ASQS** – an interaction between the user and the ASQS in which the user types responses to a series of structured questions designed to define software and system quality requirements and priorities. Questions cover both general characteristics and those specific to applications. The end result of the Consultation is identification of areas of quality needing focussed attention, expressed in a matrix of weighted values for software factors, or a tailored/quantified framework.

**Consultation Log Window** – An ASQS-generated window, displayed upon user selection of Consult and Show Rankings, for recording all non-trivial conclusions reached by ASQS as a consequence of user-supplied answers in the Question Window and information in the ASQS knowledge/rule base.

**Consultation Options Setup Window** – a window opened when the user selects User Options and Consultation Setup from attached menu on the ASQS Roadmap. User selects this to set the default consultation window(s) size, placement, and default font size. Each consultation window has two primary font and window sizes (small and large). Switching between the two is accomplished by using the left and middle mouse buttons during a consultation to toggle between the sizes. In order to change the default font or window size, select the current size to access a pop-up menu for selecting the new size. In order to change the default window placement of the 3 consultation windows, select the current setting with the left button and enter a new setting by typing the desired number. When finished changing the options, select DONE to return to the top-level roadmap.

**Consultation Screen** – an ASQS-generated display of four windows for the user to work interactively with ASQS to define the software quality framework and quality goals (see Why Window, Consultation Log Window, Conclusion Window, and Question Window).

**Continue** – an option appearing on several attached menus to move the ASQS interaction to the next step.

**Copy Characteristics** – one of the System Decomposition Window choices allowing the user to copy characteristics from one node of a project to the current project under specification. Viewers select nodes or functions, or select from an attached menu, groups of characteristics to copy.

**CSC** – Computer Software Component, a distinct part of a computer software configuration item (CSCI). CSCs may be further decomposed into other CSCs and Computer Software Units (CSUs).

**CSC Integration and Testing** – one of nine options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where CSCs are integrated and tested (previously the CSCs were tested separately), including Test Readiness Reviews (TRRs).

**CSCI** – Computer Software Configuration Item, software or a software portion that is managed throughout the software development cycle as a single item.

**CSCI-level Testing** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where CSCIs are tested, including Functional and Physical Configuration Audits (FCA/PCA).

**CSU** – Computer Software Unit (see Unit).

## **D**

**Data Presentation** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to select system characteristics related to formatting and transforming data for understandable display to humans (see Select Data Presentation Parameters and Select Data Presentation Capabilities).

**Database Management** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to select system characteristics related to management, storage, and access to large amounts of data.

**Decompose** – one of the System Decomposition Window choices allowing the user to define branches (nodes) of the System Decomposition Tree into lower-level branches or leaves (children).

**Defense and surveillance system** – software for performing threat detection, evaluation, and warning aboard a vehicle.

**Delete** – one of the System Decomposition Window choices allowing the user to delete a selected function node from the System Decomposition Tree.

**Delete Answer** – one of six choices on the attached menu for the Answer Window, part of the Review/Change Answers process, allowing users to select an answer for deletion.

**De-select Functions** – an option made available every time a user is prompted to select functions, allowing the user to de-select a selected (highlighted) function from the decomposition tree.

**Detailed Design** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where a preliminary, often high-level design, is expanded and defined to include more details and lower-level functionality, and sometimes pseudo or intermediate code.

**Determine Disposition of Changes** – an ASQS selection allowing the user to select a reason for the changes to a version of the quality specification (see Refining/Enhancing, Exploring Possibilities, Discard Changes, Options sub-menu).

**Development characteristics** – One of the choices on the attached menu for the Review/Change Answers Window allowing users to select system characteristics related to how the system will be developed. For example, "What computer language will be used?"



**DirGrapher** – Xerox option on Background Utilities Menu allowing users to create a graphic tree-structure diagram of the current organization of directories and subdirectories on the Xerox workstation disk.

**Discard Changes** – one of the choices on the attached menu for the Disposition of Changes Window allowing the user to discard or delete any changes made to the current version of the quality specification, and return to the previous version.

**Disposition Prompt Window** – an ASQS-generated window appearing whenever the status of pending changes to the specification must be determined. ASQS generates a Disposition Prompt Window (see Disposition of Changes). This window usually appears when the user must (re)set the current version of the specification or at the end of a consultation when answers and rankings may have changed.

**DoD** – Department of Defense

**DOD-STD-2167A** – Department of Defense Standard, Defense System Software Development, setting out recommendations and requirements for the software development process for mission-critical weapon systems. The standard covers areas such as phases of the system life cycle and software development cycle, development methodologies, required products and processes (including reviews and documentation). ASQS supports both the process and the products outlined in 2167/2167A.

## **E**

**Environment characteristics** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to select system characteristics related to the environment in which the software or system must operate. For example, "Is this an embedded system?"

**Expand** – Xerox option on Window Utilities Menu allowing users to restore an icon to a regular window.

**Expert system** – a computer workstation with a logic software shell and a topic-specific knowledge/rule base, allowing the system to infer characteristics and draw conclusions about the subject matter in accordance with inference rules contained in the rule base.

**Explain** – one of the System Decomposition Window choices allowing the user to prompt a functional explanation of a node from the System Decomposition Tree. One of the choices on the attached menu for the Consultation Answer Window, part of the Review/Change Answers process, allowing users to read a text explanation of how ASQS arrived at an answer.

**Exploring Possibilities** – one of the choices on the attached menu for the Disposition of Changes Window allowing the user to evaluate alternative versions of the specification, to save the changes to a version, to enter the reasons for and a description of the extent of changes, and to not set the version as the new current working version of the quality specification.

## F

**Factor Gauges Panel** – the panel, appearing when the user selects consult and Show Rankings from the Ranker Options Menu, shows the amount of accumulated evidence, in scores ranging from 0 to 1, indicating that a certain factor is needed for a function. The panel, appearing when the user selects Revise Rankings Based on Factor Interrelationships from the Ranker Roadmap, shows evidence, in scores ranging from -1 to 1, indicating the extent of interrelationships between factors.

**Factor Gauges Panel Window** – one of the Windows opened by ASQS during a Consultation, when the user selects Consult and Show Rankings from the Ranker Options Menu.

**Factor Identification Form** – see Software Quality Factor Identification Form.

**Factor Ranking Window** – an ASQS-generated window appearing at the end of a consultation showing the rankings for a function in terms of each software quality factor (see Software Quality Factor Identification Form).

**FileBrowser** – Xerox option on Background Utilities Menu allowing users to access user interface for manipulating files stored on the Xerox Workstation or filesaver.

**Flight control system** – software for operating avionics flight control functions.

**Functional characteristics** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to select system characteristics describing what the system or software will do. For example, “Does this system need to perform data base management?”

## G

**Generate Questions** – This option on the attached menu for the ranking window allows the user to select a phase, then automatically generate (print) a worksheet of applicable metric questions for the selected phase.

**G-How** – a selection on the ASQS Question Window, which users select to see a graphic display (tree structure) of the reasoning chain leading to certain conclusions. Users can scroll the tree structure through the window and select parameters (see Parameter Options Menu) or rules (see Rule Options Menu) for further explanation.

**Glossary** – This selection on the Options Menu or Window attached menu displays the ASQS Glossary Window. This window can be reshaped to any desired size and scrolled up/down, right/left to view the entire glossary contents. When one of the glossary terms is selected with the left mouse button, its definition will be displayed in the ASQS-Help window.

**Guided weapon system** – a system such as an air-to-air vehicle, an air-to-ground missile, and a remotely-piloted vehicle.

## H

**Hardcopy** – Xerox option on Window Utilities Menu allowing users to send a snapshot (see Snap), or the Log Windows, to a printer or a file.

**Help** – a selection on context-specific several ASQS windows, prompt windows, and option menus allowing the user to access context-specific on-line help on ASQS procedures and actions.

**How** – 1) – a selection on the ASQS Question Window, which users select to receive a text explanation of how a conclusion was reached. When the user selects How, ASQS generates a pop-up menu of numbered choices specifying the rules and inferences, which the user can select for further text explanation. A better alternative for this action is to select G-How. 2) A selection on the Parameter/Rule Options Menu, which a user selects to view a text explanation in the Why window of the reasoning chain for a selected parameter or rule.

## **I**

**Identify Application/Function** – a Ranker Roadmap selection to identify a system or project, its software type, and functional decomposition.

**Identify Mission Area** – an ASQS selection to choose a mission area to categorize a software project, as part of the Identify Application/Function selection.

**Identify Project** – an ASQS selection to provide a short name and description for the project or select an existing project name from an attached menu associated with each Mission Area and Software Type, as part of the Identify Application/Function selection.

**Identify Software Type** – an ASQS selection to choose a project's software type from an attached menu associated with each Mission Area, as part of the Identify Application/Function selection.

**Idle** – Xerox option on Background Utilities Menu allowing users to put the Xerox workstation into Idle mode to save the phosphor of the display screen.

**Incremental Pointer** – a small black arrow on a scroll bar initiating directional movement of the document by increments. The left mouse button is used for a left incremental movement, the right button for right incremental movement.

**Intelligence system** – software for operating C3 intelligence measures and countermeasures.

## **L**

**Launch vehicle system** – software to control systems and functions in a launch vehicle.

**List Properties** – a selection on the Parameters Option Menu, which the user selects to view a listing of all the properties of a selected parameter, including all the rules that use that parameter.

## **M**

**Metrics framework** – a set of interrelated elements defining measurable characteristics of software quality. Elements of the framework include Factors, Criteria, Metrics, and Metric-elements.

**Mission Area** – one of several categories of software systems listed on an attached menu, such as Space/Missiles and Command Control and Communications, for defining a software project in ASQS.

**Mission Area Selection Prompt Window** – the ASQS-generated window appearing when the user selects Identify Application/Function from the Ranker Roadmap. This window has an attached list of mission areas (see Armament, Avionics/Airborne Systems, Command Control and Communications, Space/Missiles, Software Tools).

**Mouse** – a hardware device for data and command selection on a workstation. The mouse consists of photoreceptor cells for tracking mouse-cursor movement and buttons for selecting items and performing actions on data (such as selecting, opening, closing, dragging, etc.).

**Move** – Xerox option on Window Utilities Menu allowing users to relocate a window to another area of the screen by pulling or pushing it with the cursor/screen pointer.

## **N**

**No** – an answer a user selects from a list in response to an ASQS-generated question related to a software development project, as part of an ASQS consultation.

## **O**

**Options** – a selection to reach the options sub-menu by holding down the left mouse button when over the main menu item to shade it, then sliding the cursor to the right in the direction of the arrow. When the sub-menu appears, the user slides the cursor to the desired item and releases the mouse button to make the selection.

**Options sub-menu** – a sub-menu attached to other menus and containing a set of standard choices including Roadmap (return to Roadmap menu), Help, Glossary, and Previous Step (the one immediately prior to the current action).

## **P**

**Paint** – Xerox option on Window Utilities Menu allowing users to draw and make notations on snapshots (see Snap).

**Parameter** – an element of the ASQS knowledge base, about which questions are asked and conclusions are made; an element making up a rule.

**Parameter Option Menu** – an ASQS-generated sub-menu appearing when a user selects a parameter from the tree structure in the Graphic How Window (see List Properties, Show Answer, How, Toggle Graph Display).

**Parent** – The higher-level node on a Tree Structure is the parent to the lower-level nodes. .

**Path Selection Box** – on ASQS Roadmap windows, icons used to access ASQS higher-level functions.

**Positional Pointer** – a small, gray arrow on a scroll bar, initiated by pressing the middle mouse button when the screen pointer is in the scroll bar, to move the display of the file to a particular place (for example, 2/3 of the way through).

**PP (Pretty Print)** – a selection on the ASQS-generated Rule Options Menu, which is displayed when a user selects a rule from the tree structure in the Graphic How Window. When this option is selected, ASQS lists the actual Lisp implementation of the rule.

**PPT (Pretty Print Terse)** – a selection on the ASQS-generated Rule Options Menu, which is displayed when a user selects a rule from the tree structure in the Graphic How Window. When this option is selected, ASQS lists an abbreviated translation of the rule.

**Preliminary Design** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where final software and system requirements are implemented into an initial design.

**Project historian** – ASQS role in the software quality specification process, as a result of the system's feature for maintaining versions of the quality specification.

**Project Selection Prompt Window** – the ASQS-generated window appearing when the user has completed the step of identifying a software type and mission area.

**Prompt window** – on ASQS windows, a section of the window for instructions and help messages.

**PSW** – Xerox option on Background Utilities Menu allowing users to open a Process Status Window, for examining and manipulating existing processes.

## Q

**Qualify Metrics** – one of the selections on the Quantifier Roadmap allowing users to select for measurement the specific software criteria and their metric elements most appropriate to the system under consideration. The output of this process is a tailored quality metrics framework.

**Qualify Metrics Option Menu** – see Ranker Option Menu.

**Quality factors** – areas of system quality on which software quality has a large impact. Examples: efficiency, portability, reliability, maintainability, integrity.

**Quality goals** – measurable goals for software quality set for a system by the program or acquisition manager, based on an evaluation of the system and software characteristics, requirements, and priorities.

**Quality metrics** – measurable elements of the software quality framework. An example for anomaly management is “whether error tolerances have been specified for external data input.”

**Quality requirements** – see Quality goals.

**Quantified Metrics Framework** – a tailored version of the ASQS metrics framework, so that each metric element, quality criterion, and quality factor has both an upper-bound value with a certainty factor and a lower-bound value with a certainty factor.

**Quantifier Roadmap** – an ASQS-generated window for qualifying and quantifying metrics used in quality measurement and comparing a project’s quality goals with those of other projects.

**Quantify Factors** – the ASQS Roadmap selection to access the Quantifier Roadmap. One of the ASQS top-level functions.

**Quantify Metrics** – one of the selections on the Quantifier Roadmap allowing users to quantify metric elements in the tailored framework (see Consult and Show Rankings). The reason for quantifying metrics is for ASQS to set an expected range of values (baselines of upper and lower bounds) for each metric element, quality criteria, and quality factor in the tailored framework as guidance to the user for setting quality goals. For this process, ASQS uses four sources of information: user-supplied baselines, baselines inferred from information acquired during consultations, baselines in existence for other projects in the same mission area, and general baselines synthesized from projects not necessarily within the same mission area.

**Quantify Metrics Option Menu** – see Ranker Option Menu.

**QUES** –Quality Evaluation System, used in the Assess Compliance functions of ASQS.

**Question Window** – an ASQS-generated window on the Consultation Screen, displayed upon user selection of Consult and Show Rankings, where ASQS poses questions and the user types the answer or selects one from an attached menu (see Why, How, G-How, Help, Stop, CF, Comment, Change).

## **R**

**Range system** – all the software to operate functions of a defensive or offensive radar and threat detection system.

**Rank Factors and Criteria** – the ASQS Roadmap selection to access the Ranker Roadmap. One of the top-level functions of ASQS.

**Ranker Option Menu** – the window/menu that ASQS displays when the user selects Assign Factors and Criteria Rankings, Revise Rankings Based on Interrelationships, Revise Rankings Based on Cost, Quantify Metrics, or Qualify Metrics, each with an option menu of choices (see Review/Change Answers, Consult and Show Rankings, Show Rankings, Version Management, and Options sub-menu).

**Ranker Prompt Window** – an ASQS-generated window appearing when the user selects Show Tailored Framework from the Qualifier Factor Identification Form, or Quantify Metrics from the Quantifier Roadmap.

**Ranker Roadmap** – an ASQS-generated window for the ASQS function Rank Factors and Criteria, where users identify and decompose system functions and revise quality rankings.

**Ranking** – a value or score ASQS assigns to a function for each software quality factor and criterion indicating the need for this factor or criterion.

**Ranking windows** – ASQS-generated windows for displaying a value matrix of rankings (High, Medium, Low) indicating the relative need of quality factors for a particular function. When the user selects a value with the cursor, ASQS provides an explanation of how ASQS arrived at the value.

**Read Note** – one of the System Decomposition Window choices allowing the user to read a note from the prompt window. One of the choices on the attached menu for the Answer Window, part of the Review/Change Answers process, allowing users to read notes.

**Reconnaissance/electronic warfare system** – all the software for reconnaissance and electronic warfare measures and countermeasures.

**Redisplay** – Xerox option on Window Utilities Menu allowing users to bring back the contents of a window accidentally Cleared (where applicable).

**Refining/Enhancing** – one of the choices on the attached menu for the Disposition of Changes Window allowing the user to save changes to a version, enter the reasons for and a description of the extent of changes, and to set the version as the new current working version of the quality specification.

**Report Selection Box** – on ASQS Roadmap windows displays icons for selecting commonly-used reports generated by ASQS.

**Reset Current Version** – one of the choices on the attached menu for Version Management allowing the user to select a version as the current operating version.

**Review/Change Answers** – one of the options on the Ranker Option Menu allowing users to review previous consultation results and change answers to ASQS questions. The selection initiates a three-step process of selecting functions for review, selecting characteristics for review, and reviewing/changing the answers (see System Decomposition Window, Characteristic Selection Prompt Window, Answer Window).

**Review Conflicts** – one of the choices on the attached menu for the Copy Characteristics Window allowing users to review the conflicts between the current set of characteristics and those to be copied.

**Revise Rankings Based on Interrelationships** – a selection on the Ranker Roadmap allowing users to run a consultation session to respond only to questions concerning factor interrelationships. The output of this process is a revised Factor Identification Form.

**Revise Rankings Based on Cost** – a selection on the Ranker Roadmap allowing users to revise rankings to reflect costs involved in setting and achieving software goals at certain levels. Relative cost of a specific quality factor varies over the software life cycle. Identify the applicable quality factors for a function and the impact on cost during various stages of the life cycle. Then identify goals that may be excessively costly or impossible to achieve as a result of cost constraints stemming from relationships between conflicting goals.

**Revised Rankings** – scores on the Factor identification Forms revised to reflect a confidence level that the existing factor interrelationships either assist (+) or deter (–) the attainment of specific quality goals.

**Roadmap windows** – the top-level windows in ASQS (see Ranker Roadmap, Quantifier Roadmap, and Assessor Roadmap).

**Rule** – an element of the ASQS rule base defining principles of software quality, which are made up of parameters. Each rule has a premise: if A and a conclusion, then B.

**Rule Options Menu** – an ASQS-generated menu displayed when the user selects a rule from the Graphic How window (see TRANS, PPT, PP, How).

## S

**Satellite system** – all the software to operate functionality in a satellite.

**SaveVM** – Xerox option on Background Utilities Menu allowing users to update the entire virtual memory (VM) of the workstation, preventing loss of work as a result of accidental shut-down. Default SaveVM occurs automatically every 10 minutes or when the machine is idle.

**Screen pointer** – the cursor, shown as a small diagonal arrow.

**Scroll bars** – rectangular boxes appearing when selected on the side or bottom of certain windows to allow viewing of material not visible because of the size of the window relative to the size of the contents. Horizontal (bottom) scroll bars allow the user to scroll the file contents left and right; vertical scroll bars shift up and down. For both types, window size and placement in the screen remain the same.

**Select Data Presentation Capabilities** – one of the options for the Data Presentation choice as part of the process for Selecting Characteristics for Review/Change allowing users to select characteristics specific to data presentation.

**Select Data Presentation Parameters** – one of the options for the Data Presentation choice as part of the process for Selecting Characteristics for Review/Change allowing users to select parameters specific to data presentation.

**Select Database Management Capabilities** – one of the options for the Database Management choice as part of the process for Selecting Characteristics for Review/Change allowing users to select capabilities specific to database management.



**Select Database Management Parameters** – one of the options for the Database Management choice as part of the process for Selecting Characteristics for Review/Change allowing users to select parameters specific to database management.

**Select Functions** – an option used throughout ASQS, allowing the user to select (highlight) one or more functions from a decomposition tree.

**Select Phase** – the first step of the ASQS selections Show Tailored Framework (Qualify Metrics on the Quantifier Roadmap) and Show Quantified Framework (Quantify Metrics on the Quantifier Roadmap).

**Select Phase Window** – the ASQS-generated window appearing when the user selects Show Tailored Framework or Show Quantified Framework. These windows have an attached menu of options (software and system development phases) for the user to select (see System Software Requirements Analysis, Software Requirements Analysis, Preliminary Design, Detailed Design, Coding and Unit Testing, CSC Integration and Testing, CSCI-level Testing, System Integration and Testing, Options).

**Select Survey Capabilities** – one of the options for the Survey Results choice as part of the process for Selecting Characteristics for Review/Change allowing users to select capabilities specific to surveys.

**Select Survey Parameters** – one of the options for the Survey Results choice as part of the process for Selecting Characteristics for Review/Change allowing users to select parameters specific to surveys.

**Sensor fused weapon system** – a system such as a laser-guided bomb.

**Shape** – Xerox option on Window Utilities Menu allowing users to change the dimensions of a window to allow viewing of larger portions of data in the window.

**Show Answer** – a selection on the Parameter Options Menu, which users select to view the current answer for a selected parameter.

**Show Quantified Framework** – a selection on the attached menu for the Factor Identification Form created during the Quantify Metrics process. The form shows the expected range of values for each metric, for one selected life-cycle phase.

**Show Rankings** – one of the options on the Ranker Option Menu allowing users to display the current quality factor rankings, select them and read explanations of the value. When users select this option, ASQS runs through a consultation passively and re-computes the rankings and confidence levels.

**Show Tailored Framework** – one of the selections on the Qualifier Factor Identification Form allowing the user to display the tailored framework (see Select Phase).

**Shrink** – Xerox option on Window Utilities Menu allowing users to convert a window to an icon to increase space on the screen display.

**Snap** – Xerox option on Window Utilities Menu allowing users to make copies of user-selected screen displays.

**Software** – electronic media required to operate computer hardware.

**Software development cycle** – a series of discrete and overlapping phases in the development of software as a part of the system life cycle. Software development phases include requirements definition and analysis, system and software specification, coding, testing, and maintenance.

**Software development environment** – a set of tools, utilities, and applications housed in one facility to support the development and maintenance of software; includes such items as compilers, assemblers, hardware platforms, operating systems, simulators, modelers, and other development and diagnostic tools and utilities.

**Software Quality Factor Identification Form** – the Factor Ranking Window showing a matrix of software factors and scores (rankings) for a selected function of a system. When a user selects a score, ASQS displays the reasoning chain for obtaining that ranking, using a tree structure.

**Software quality specification** – the results of a consultation created by ASQS for each system or project identified by the user. ASQS maintains version(s) of the specifications as changes are made throughout the software development cycle and also maintains a log of the reasons for the changes.

**Software Requirements Analysis** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where requirements for software are analyzed and defined, and the Software Specification Review (SSR) typically held.

**Software Requirements Specification (SRS)** – a 2167 Data Item Description defining the contents and format for specifying software requirements.

**Software Tools** – one of the mission areas listed on the attached menu for the Mission Area Selection Prompt Window. Software Tools includes software and systems related to the software engineering and development environment.

**Software Type Selection Prompt Window** – the ASQS-generated window appearing when a user has completed identifying a mission area. This window has an attached menu of different types of software; the list varies depending on the mission area selected.

**SONS** – an answer ASQS supplies indicating that a characteristic has multiple answers. On the Answer Window, the user selects the SONS answers to see a pop-up answer menu. To avoid this level of indirection and to directly view the characteristics themselves requires a return to the Selection of Characteristics prompt window to select the sub-menus for Data Presentation, Database Management, or Survey Results, the characteristics having multiple answers.

**Space/Missiles** – one of the mission areas listed on the attached menu for the Mission Area Selection Prompt Window. Space/Missiles includes software and systems for space-based weapon and missile systems.

**Space/vehicle system** – software to operate and control all functions and systems of a space vehicle.

**Stop** – a selection on the ASQS Question Window, which users select to stop the consultation session and save the answers up to this point.

**Strategic C3 system** – all software to operate functions in a strategic C3 system.

**Sub-menu indicator** – a small arrowhead on a menu option indicating that the option has a listing of additional options (see Options sub-menu).

**Survey Results** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to enter system characteristics information obtained from surveys of individuals knowledgeable in systems of this type (see Select Survey Parameters and Select Survey Capabilities).

**System Decomposition Window** – an ASQS-generated window appearing at completion of the Identify Application/Function option. At this point, the user identifies each function of the project with separate quality requirements to decompose the system. The decomposition is shown in a tree structure and has a sub-menu of options (see View Description, Change Name, Change Description, Change Weight, Delete, Decompose, Add Child, Combine, Copy Characteristics, Read Note, Explain, Version Management, Option Sub-Menu, and Continue). The System Decomposition Window also appears when the user selects Review/Change Answers from the Ranker Option Menu and Consult and Show Rankings from the Quantifier Option Menu.

**System factors** – one of the choices on the attached menu for the Review/Change Answers Window allowing users to select quality factors related to system-level issues such as Availability, Safety, and Transportability.

**System Integration and Testing** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where software and hardware making up a system are integrated and tested (previously, they were tested separately), including Functional and Physical Configuration Audits (FCA/PCA).

**System life cycle** – a series of discrete and overlapping phases in the life of a system, consisting of such phases as concept exploration, production, deployment, and maintenance.

**System Prompt Window** – Xerox workstation window displaying status messages concerning input/output devices and processes, and Help messages for Window and Background Utility options.

**System/Segment Specification (SSS)** – a 2167 Data Item Description defining the contents and format for specifying system and segment requirements.

**System Software Requirements Analysis** – one of the options on the attached menu for Select Phase – Show Tailored Framework Option. Describes a phase of system/software development where system requirements are analyzed and defined.

## T

**Tactical C3 system** – a command, control and communication system such as JTIDS (AWACS) and AFWIS.

**Tailored Metrics Framework** – the ASQS-generated window showing a tree structure of the framework of tailored metrics for a specific system. The same rules apply for viewing and scrolling a tree structure and making selections from the attached menu of How, View Description, Options, and Continue.

**TEdit** – Xerox option on Background Utilities Menu allowing users to open an Interlisp text editor window for entering, editing, formatting, and printing documents and reports.

**Test equipment software** – software for testing avionics applications and systems.

**Toggle Graph Display** – this option on the Parameter Options menu changes the explanation graph display between showing only rules/parameters that impacted the conclusions and all rules/parameters that did impact and could have impacted the conclusions.

**Tracking surface** – the special cardboard mat used with the mouse.

**Training/simulator software** – software performing training for or simulating execution of avionics systems.

**TRANS** – a selection on the ASQS-generated Rule Options Menu, displayed when a user selects a rule from the tree structure in the Graphic How Window. When this option is selected, ASQS displays an English translation of the selected rule.

**Tree window** – one of the ASQS-generated windows displaying a tree structure graphically for 1) a tailored metrics framework, 2) a functional system decomposition, or 3) version histories of a project's software quality specification, and 4) a quantified framework for a selected project.

## U

**Unit** – a Computer Software Unit, an element specified in the design of a Computer Software Component (CSC) that is separately testable.

**Unknown** – one of a list of responses on an attached menu that a user selects when the answer to a question is unknown.

**Unknowns Window** – an ASQS-generated window appearing automatically on the Consultation Screen, which gives the percentage of Unknown answers versus Other answers for each function, using a pie chart format.

## V

**Version Management** – one of the System Decomposition Window choices allowing the user to view or change a version of the quality specification and have ASQS log the history of the changes and versions.

**Version Management Tree** – the ASQS display of the relationship of versions of a project's software quality specification, tracing the evolution of different versions of the specification reflecting changes throughout the development cycle.

**View Author** – one of the choices on the attached menu for Version Management allowing the user to read the name of the author of a selected version.

**View Box** – a gray shaded area, in a scroll bar, which moves to indicate the relative percentage of the file viewed. For example, if you move a view box with the screen pointer 2/3 of the way down a scroll bar, the window displays the file about 2/3 of the way through it.

**View Creation Date** – one of the choices on the attached menu for Version Management allowing the user to view a listing of the creation date of a selected version.

**View Description** – 1) – one of the System Decomposition Window choices allowing the user to view a description of a selected function node on the System Decomposition Tree. 2) – one of the choices on the Version Management Window allowing the user to view a text description of the characteristics of the version (reasons for changes and type of specification).

**View Version Type** – one of the choices on the attached menu for Version Management allowing the user to see a listing of the reason for the creation of the new version.

## **W**

**War planning system** – software for planning strategies (for example, for computer simulations, or missile and aircraft strategies).

**What-if scenario** – an on-line opportunity for users to review the merits and drawbacks of alternative versions of the software quality specification, by running consultations, reviewing/changing answers, and using the Evaluating Alternatives function of ASQS.

**Why** – a selection on the ASQS Question Window, which users select to get a text explanation of why ASQS is asking a question.

**Why Window** – an ASQS-generated window on the Consultation Screen, displayed upon user selection of Consult and Show Rankings, for displaying Why and How explanations requested by the user in the Question Window. When the user selects Why from the Question or Graphic How Window, ASQS lists in the Why Window all rules, inferences, and answers used to reach the conclusion and also provides a confidence factor in the correctness of the conclusion in parentheses at the end of the conclusion. The user (re-)selects How or Graphic How (G-How) to follow the line of reasoning.

**Window** – a discrete area of the terminal screen, displayed as a box and used as a workspace, for performing actions on specific associated information. In ASQS, examples include: Why Window, Top-level Roadmap Window, Banner Windows, Consultation Window, and others.

**Window Utilities Menu** – a list of options available with an ASQS or Xerox workstation window (varies with the type and function of window).

## **Y**

**Yes** – an answer a user selects from a list in response to an ASQS-generated question related to a software development project, as part of an ASQS consultation.

## APPENDIX C

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## APPENDIX D

### System Administration

#### Who Should Read this Section?

Normal Users who need to know how to change their own passwords.

System Administrators for the Assistant for Specifying the Quality of Software; that is, those persons designated as administrators or super-administrators of the system and with responsibility for adding and deleting usernames and specifying user access rights to projects and mission areas.

Administrators, like Normal users, log on to ASQS using the method described in Appendix A. At this time, the super administrator (at Rome Air Development Center) has defined the new account as an administrator account, giving you privileges for creating and modifying normal and other administrator user accounts and setting user access to mission areas and projects.

At the Main Roadmap, select System Administration from the Option Menu. This choice gets you to the System Administration Option Menu. Users are shown only menu options for the system administration functions for which they have privileges.

The Option Menu for Administrators has six choices as shown in Figure D-1. Selecting Options gives you the standard four options of Roadmap, Help, Glossary, and Previous Step. The other options are described below.

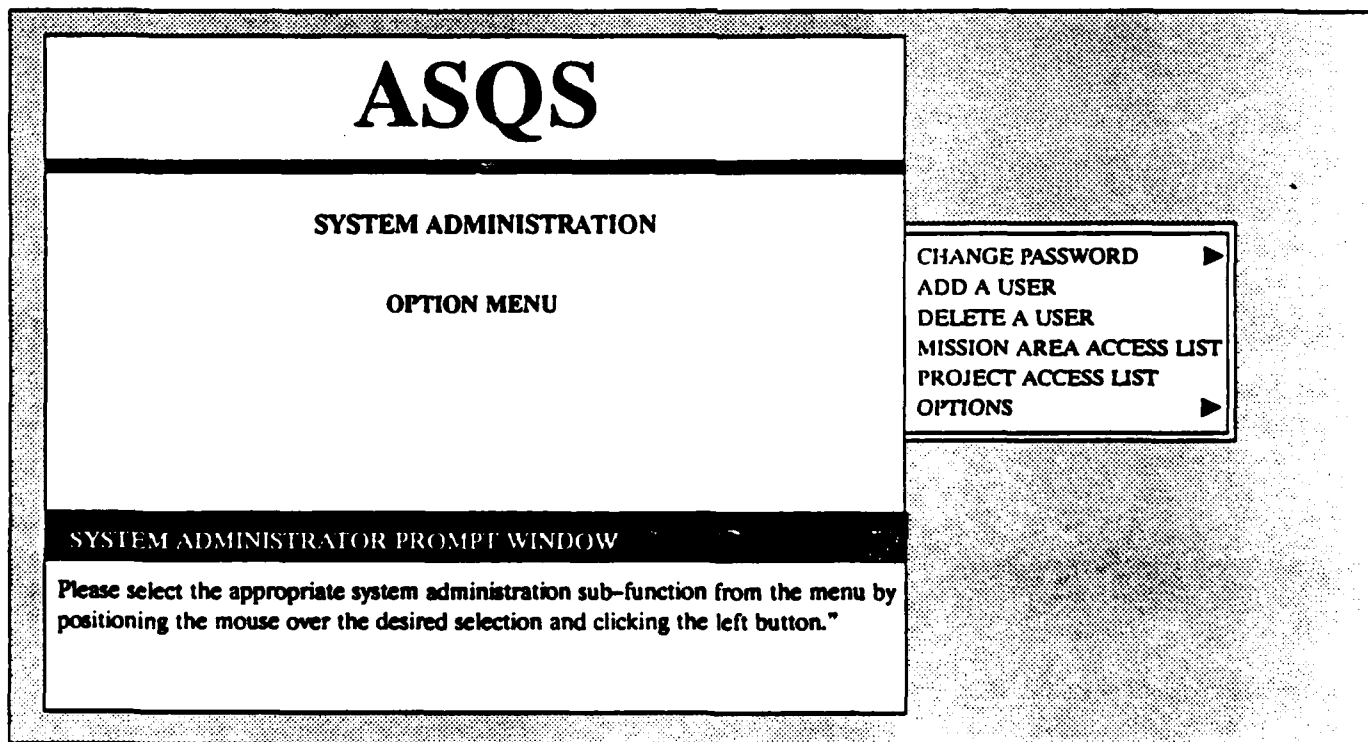
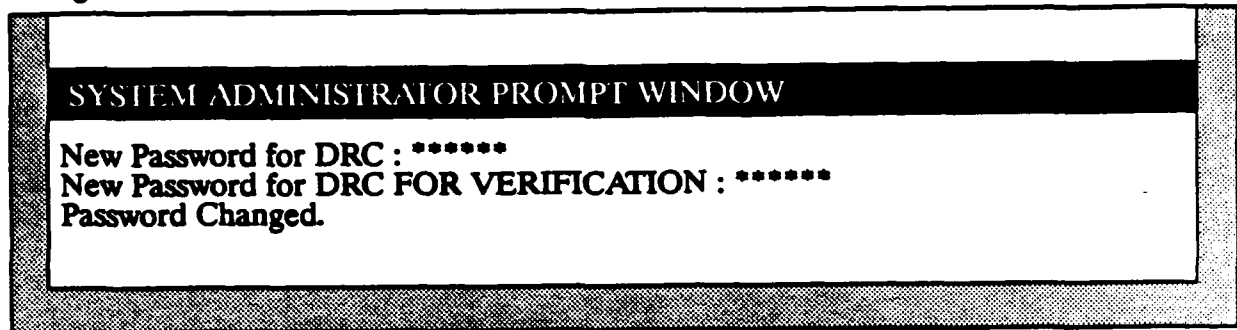


Figure D-1 The System Administration Option Menu

**Change Password:** This option has two choices, changing your own password or changing someone else's password. Select the option you need, the process is the same, as shown in Figure D-2.



**Figure D-2 The System Prompts for Changing an Administrator's Password**

At each system prompt, type in the correct information and press <CR>.

**Add a User:** when you select this option, the system prompts for the

Username to Add:

Type in the name, and press return. The system prompts for the

Password for \_\_\_\_:

Passwords must be at least four (4) characters long. After you type in the password, the system prompts for a

Password Verification for \_\_\_\_:

Type in the password a second time to verify. If the two passwords don't match, the new account is not added and the entire procedure must be repeated.

For Administrator accounts, if the verification is correct, the system prompts:

Will this user be an Administrator?

Only Administrators can create other Administrator accounts. Type Y for yes or N for no. You do not need to press return. The system prompts:

User \_\_\_\_ ADDED.

**Delete A User:** Normal users can not delete other usernames. System Administrators can delete usernames except their own and the Super Administrator's. Even a System Administrator cannot delete a user who currently has sole ownership of a project. First, you must change user permissions so that someone else has ownership. When you select Delete A User, ASQS presents a menu containing all the current usernames. The spacebar allows you to keep scrolling to see all the usernames. Select a username with the mouse and the system prompts:

About to Delete \_\_\_\_ [Confirm]:

Type Y for yes and N for No. If yes, the system prompts

User \_\_\_\_ Alias ASQS-USER-# Deleted.

For this choice, the ? gets additional options or help.

**Mission Area Access List:** Only system administrators can change user access to mission areas. Users are given access to a Mission Area of own, read, write, or no access. Mission Areas can have more than one owner. The privilege "own" gives a user the capability of creating and owning projects in that mission area. The privileges of read (browsing material without the ability to make any changes) and write (making changes to a project specification) to a Mission Area are necessary prerequisites to any privileges of accessing projects in a Mission Area.

When you select Mission Area Access List, ASQS gives you a list of the Mission Areas and all usernames and their current status in the Mission Areas (see Figure D-3).

	OWN	WRITE	READ	NO ACCESS
MISSION AREA				
	DRC	ADMIN	LARRY	NEW-USER1
Armament	READ	OWN	READ	WRITE
Avionics/Airborne Systems	READ	READ		
Command Control and Communications	OWN	OWN		
Space/Missiles	OWN			
Software Tools	WRITE		OWN	

**Figure D-3 The Mission Area Access List Window**

Follow the directions of the system prompt and first select an access type, then select a username column and Mission Area row, clicking the mouse button (left or middle) to set the access to the one selected. For example, if you select No Access, you can set all the No Access privileges (which is indicated by a blank in the username column), then select another access type, Read or Write, and set these username privileges.

**Project Access List:** System Administrators and project owners can change user access to specific projects. User access to Mission Areas is a necessary prerequisite to accessing projects, which may be assigned to more than one Mission Area. Users with access to projects in other Mission Areas may need access to projects in other areas, especially if they have any similar characteristics. Selecting access types, usernames, and projects follows the same procedure as for the Mission Area Access List.

Normal users with Mission Area "Own" privileges can create and own projects in that Mission Area. They can also set other username access privileges for those projects that they own.

ASQS

Project access list Window
OPTIONS ►

Please select the desired access type and then select the users/mission areas.

OWN

WRITE

READ

.....NO ACCESS.....

PROJECT

DRC ADMIN LARRY NEW-USER1

AMH

Satellite Control Facility (FCF)  
Titan prelaunch checkout software  
Control launch engine pressure  
Stability control system  
Onboard lifesupport systems  
Onboard radar software  
Generic System  
Satellite 2  
Generic system  
Stars SEE  
SDME  
JIMBO  
STARS SEE  
SDME  
Ada Compiler  
C Compiler  
FORTRAN COMPILER

READ  
WRITE  
WRITE

WRITE  
OWN  
OWN  
OWN

READ  
WRITE

Figure D-4 The Project Access List Window

The Project Access List has a scrollbar to let you scroll the window to see all the projects. To access the scrollbar, place the cursor on the left border and drag the cursor across the border. While you are in that area, use the right mouse button to scroll the list down and the left mouse button to scroll the list up. The middle button lets you set the cursor to the position of your choice.

When you have finished any System Administration functions, select Roadmap from the Option Menu to return to the top-level roadmap.



## *MISSION of Rome Air Development Center*

*RADC plans and executes research, development, test and selected acquisition programs in support of Command, Control, Communications and Intelligence (C<sup>3</sup>I) activities. Technical and engineering support within areas of competence is provided to ESD Program Offices (POs) and other ESD elements to perform effective acquisition of C<sup>3</sup>I systems. The areas of technical competence include communications, command and control, battle management information processing, surveillance sensors, intelligence data collection and handling, solid state sciences, electromagnetics, and propagation, and electronic reliability/maintainability and compatibility.*